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Metals in waste water and sludge

Mirja Leivuori, Riitta Koivikko, Timo Sara-Aho, Teemu Näykki, Keijo Tervonen, Sari Lanteri, Ritva Väisänen and Markku Ilmakunnas

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Proftest SYKE

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ABSTRACT

Interlaboratory Proficiency Test 10/2017

Proftest SYKE carried out the proficiency test (PT) for elemental analysis of waste waters and sludge in October 2017 (MET 10/2017). The measurands for the synthetic samples were: Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, V, and Zn. These measurands were also analysed from the waste water samples as well as measurands B, Ba, Ca, Mg, Mo, Sb, Sn, Sr, and S_{tot}. In addition to the aforementioned, also measurands N_{tot}, P_{tot}, and dry weight were analysed from the sludge sample. In total 26 laboratories participated in the PT. In this proficiency test 91 % of the results were satisfactory when deviation of 5 – 30 % from the assigned value was accepted.

Basically, either the metrologically traceable concentration, calculated concentration, the robust mean, mean or median of the results reported by the participant was used as the assigned value for measurands. The evaluation of the performance of the participants was carried out using z scores. In some cases the evaluation of the performance was not possible e.g. due to the low number of the participants or the high deviation of reported results. There, when possible, D% scores were calculated. Warm thanks to all the participants of this proficiency test!

Keywords: water analysis, metals, Al, As, B, Ba, Ca, Cd, Co, Cr, Cu, Drw, Fe, Hg, Mn, Mg, Mo, N, Ni, P, Pb, S, Sb, Se, Sn, Sr, V, Zn, water, environmental laboratories, proficiency test, interlaboratory comparison

TIIVISTELMÄ

Laboratorioiden välinen pätevyyskoe 10/2017

Proftest SYKE järjesti pätevyyskokeen jätevesiä sekä lietettä analysoiville laboratorioille lokakuussa 2017 (MET 10/2017). Pätevyyskokeessa määritettiin synteettisistä näytteistä metallit Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, V ja Zn. Jätevesinäytteistä määritettiin edellä mainittujen lisäksi B, Ba, Ca, Mg, Mo, Sb, Sn, Sr ja S_{tot}. Lietenäytteestä määritettiin näiden lisäksi myös N_{tot}, P_{tot} sekä kuivapaino. Pätevyyskokeeseen osallistui yhteensä 26 laboratoriota. Koko tulosaineistossa hyväksyttäviä tuloksia oli 91 %, kun vertailuarvosta sallittiin 5–30 %:n poikkeama.

Osallistujien pätevyyden arviointi tehtiin z-arvojen avulla. Testisuureen vertailuarvona käytettiin metrologisesti jäljitettävää pitoisuutta, laskennallista pitoisuutta, osallistujien ilmoittamien tulosten robustia keskiarvoa, keskiarvoa tai mediaania. Joissain tapauksissa tulosten vähäisen määrän tai suuren hajonnan vuoksi pätevyyden arviointi ei ollut mahdollista. Tällöin, mikäli mahdollista, laskettiin D% -arvot. Kiitos pätevyyskokeen osallistujille!

Avainsanat: vesianalyysi, metallit, Al, As, B, Ba, Ca, Cd, Co, Cr, Cu, Drw, Fe, Hg, Mn, Mg, Mo, N, Ni, P, Pb, S, Sb, Se, Sn, Sr, V, Zn, vesi- ja ympäristölaboratoriot, pätevyyskoe, laboratorioiden välinen vertailumittaus

SAMMANDRAG

Provningsjämförelse 10/2017

Proftest SYKE genomförde en provningsjämförelse i oktober 2017, som omfattade bestämningen av Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, V och Zn i syntetiska provet. Från avloppsvatten bestämdes också B, Ba, Ca, Mg, Mo, Sb, Sn, Sr och S_{tot}. Från slammet bestämdes genom den ovan nämnda också Drw, N_{tot} och P_{tot}. Tillsammans 26 laboratorier deltog i jämförelsen. I jämförelsen var 91 % av alla resultaten tillfredsställande, när total deviation på 5–30 % från referensvärdet accepterades.

Som referensvärde av analytens koncentration användes mest det metrologiska spårbara värdet, teoretiska värdet robust medelvärdet, medelvärdet eller median av deltagarnas resultat. Resultaten värderades med hjälp av z-värden eller beräknade D% -värden. Ett varmt tack till alla deltagarna i testet!

Nyckelord: vattenanalyser, metaller, Al, As, B, Ba, Ca, Cd, Co, Cr, Cu, Drw, Fe, Hg, Mn, Mg, Mo, N, Ni, P, Pb, S, Sb, Se, Sn, Sr, V, Zn, provningsjämförelse, vatten- och miljölaboratorier

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1 Introduction

Proftest SYKE carried out the proficiency test (PT) for elemental analysis of waste waters and sludge in October 2017 (MET 10/2017). The measurands for the synthetic samples were: Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, V, and Zn. These measurands were also analysed from the waste water samples as well as measurands B, Ba, Ca, Mg, Mo, Sb, Sn, Sr, and S_{tot}. In addition to the aforementioned, also measurands N_{tot}, P_{tot}, and dry weight were analysed from the sludge sample. In the PT the results of Finnish laboratories providing environmental data for Finnish environmental authorities were evaluated. Additionally, other water and environmental laboratories were welcomed to participate in the proficiency test.

Finnish Environment Institute (SYKE) is appointed National Reference Laboratory in the environmental sector in Finland. The duties of the reference laboratory include providing interlaboratory proficiency tests and other comparisons for analytical laboratories and other producers of environmental information. This proficiency test has carried out under the scope of the SYKE reference laboratory and it provides an external quality evaluation between laboratory results and mutual comparability of analytical reliability. The proficiency test was carried out in accordance with the international guidelines ISO/IEC 17043 [1], ISO 13528 [2] and IUPAC Technical report [3]. The Proftest SYKE is accredited by the Finnish Accreditation Service as a proficiency testing provider (PT01, ISO/IEC 17043, www.finas.fi/sites/en). The organizing of this proficiency test is included in the accreditation scope.

2 Organizing the proficiency test

2.1 Responsibilities

Organizer

Proftest SYKE, Finnish Environment Institute (SYKE), Laboratory Centre
Ultramariinikuja 4 (formerly Hakuninmaantie 6), FI-00430 Helsinki, Finland
Phone: +358 295 251 000, Email: proftest@environment.fi

The responsibilities in organizing the proficiency test

Riitta Koivikko	coordinator
Mirja Leivuori	substitute for coordinator
Keijo Tervonen	technical assistance
Markku Ilmakunnas	technical assistance
Sari Lanteri	technical assistance
Ritva Väisänen	technical assistance
Timo Sara-Aho	analytical expert (metals, ID-ICP-MS)
Teemu Näykki	analytical expert (Hg, ID-ICP-MS)

Subcontracting	Measurements of N_{tot} and Hg in sludge and dividing into subsamples: KVVY Tutkimus Oy (formerly The Water Protection Association of the River Kokemäenjoki, KVVY), accredited by FINAS (T064, www.finas.fi/sites/en)

2.2 Participants

In total 26 laboratories participated in this proficiency test (Appendix 1), 22 participants from Finland, one from Denmark, two from Sweden and one participant from Luxembourg. One participant delivered two different result sets. Altogether 69 % of the participants used accredited analytical methods at least for a part of the measurements. For this proficiency test, the organizer has the codes 18 (SYKE, Helsinki, T003, www.finas.fi/sites/en) and 20 (KVVY, N_{tot} and Hg in sludge, T064, www.finas.fi/sites/en) in the result tables.

2.3 Samples and delivery

Four types of samples were delivered to the participants: synthetic, municipal and industrial waste water as well as sludge samples. The synthetic sample A1M was prepared from the NIST traceable commercial reference material produced by Inorganic Ventures. The synthetic sample A1Hg was prepared from the NIST traceable AccuTrace™ Reference Standard produced by AccuStandard, Inc. The sample preparation is described in details in the Appendix 2. The synthetic sample A1M was acidified with nitric acid and the synthetic mercury sample A1Hg with the hydrochloric acid.

The samples V2M and V2Hg were municipal waste water with additions of single element standard solutions (AccuStandard for Hg and Merck CertiPUR® for other elements, Appendix 2). The industrial waste water samples T3M (after analysis: TN3 – no digestion / TY3 – digestion with acid or with acid mixture) and T3Hg for Hg measurements were prepared with additions of single element standard solutions (AccuStandard for Hg and Merck CertiPUR® for other elements, Appendix 2).

The tested sludge sample L4M (after analysis: L4M / LC4 – oxygen combustion (only Hg) / LN4 – digestion with HNO_3 / LO4 – digestion with HNO_3 + HCl) was from sewage treatment plant from southern Finland. In general, no addition of metals was needed with exception for Sb, Se, and Sn (Appendix 2). The addition was done with the Merck CertiPUR® solution of metals. After spiking the wet sludge was dried, homogenized and divided into sub-samples using vibrating feeder distributor.

When preparing the samples, the purity of the used sample vessels was controlled. The randomly chosen sample vessels were filled with deionized water and the purity of the sample vessels was controlled after 3 days by analyzing Cd, Cu, Hg, and Zn. According to the test results all used vessels fulfilled the purity requirements.

Due to transportation issues of the base solution the sample A1M contained only 13 measurands. Further, due to the transportation issues, the sample preparation was fastened causing the sample having 1000 times higher measurand concentrations than was foreseen.

This unfortunate situation was informed to the participants and they were requested to make necessary dilutions for the samples. The results were requested to be reported in unit mg/l (formerly µg/l). The organizer apologized any possible inconvenience.

The samples were delivered on 9 October 2017 to the participants abroad and on 10 October 2017 to the national participants. The samples arrived to the participants mainly on 11 October 2017. Participants 4 and 22 received the samples on 12 October 2017. The samples were requested to be measured as follows:

Mercury (A1Hg, V2Hg and T3Hg)	latest on 20 October 2017
The other samples	latest on 3 November 2017

The results were requested to be reported latest on 3 November 2017 and all participants delivered the results accordingly. The preliminary results were delivered to the participants via ProftestWEB and email on 10 November 2017.

2.4 Homogeneity and stability studies

The homogeneity of the water samples was tested by analyzing Cd, Cr, Cu, Hg, Pb, Se, and Zn. The homogeneity of the sludge sample was tested by analyzing Sb, Se, Sn, and Zn. More detailed information of homogeneity studies is shown in Appendix 3. According to the homogeneity test results, all samples were considered homogenous. The synthetic samples were prepared from traceable certified reference materials, and thus known to be homogenous. Based on the earlier similar proficiency tests the water samples are known to be stable over the given time period for the test.

The stability of the sludge sample was studied by analyzing Sb, Se, Sn, and Zn. The difference of the results from the homogeneity study and the result of the organizing laboratory (SYKE) during the test were compared to the criterion $0.3 \times s_{pt}$ taking into account the total measurement uncertainties. The criterion was fulfilled in each case, thus the sludge sample was considered stable.

2.5 Feedback from the proficiency test

The feedback from the proficiency test is shown in Appendix 4. The comments from the participants mainly dealt with their reporting errors with the samples. The comments from the provider focused to the sample preparation and participant's detection limit. All the feedback is valuable and is exploited when improving the activities.

2.6 Processing the data

2.6.1 Pretesting the data

The normality of the data was tested by the Kolmogorov-Smirnov test. The outliers were rejected according to the Grubbs or Hampel test before calculating the mean. The results which differed from the data more than $s_{rob} \times 5$ or 50 % from the robust mean were rejected before the

statistical results handling. If the result has been reported as below detection limit, it has not been included in the statistical calculations.

More information about the statistical handling of the data is available from the Guide for participant [4].

2.6.2 Assigned values

For the synthetic sample A1M the NIST traceable calculated concentrations were used for all measurands as the assigned value. The results based on isotope dilution (ID) ICP-MS technique were used as assigned value for Hg and Pb in samples TN3, V2M, A1Hg, T3Hg and V2Hg. The assigned value based on the ID-ICP-MS method is the mean of the homogeneity results and the test result. The ID-ICP-MS method is accredited for soluble lead in synthetic and natural waters and for soluble mercury in synthetic, natural and waste water in the scope of calibration laboratory (K054; www.finas.fi/sites/en).

For the other samples and measurands the robust mean was used as the assigned value. When the number of results was low (n(stat)<12), the mean value (LN4: B, Mo, Ni; LO4: Mn, Mo, Sr; L4M: P_{tot}, S_{tot}, TN3: S_{tot}, V; TY3: Ni, Sr) or median (LN4: all except Mo and Ni; LO4: all except Mn, Mo, Sr; TY3: all except Ni, Sr) was used as the assigned value. The proficiency estimation was not given for some measurands due to high deviation of the results (LO4: As; LN4: Sb) or low number of reported results (LN4: B, Hg, Sb; LC4: Hg; TY3: Sn, S_{tot} – D% values are given).

The used assigned values based on the robust mean, mean or median are not metrologically traceable values. As it was not possible to have metrologically traceable assigned values, the best available values were selected to be used as the assigned values. The reliability of the assigned values was statistically tested [2, 3].

The expanded uncertainty (*k=2*) for the calculated assigned values was estimated using standard uncertainties associated with individual operations involved in the preparation of the sample. The main individual source of the uncertainty was the uncertainty of the concentration in the stock solution.

For the metrologically traceable mercury and lead results, the uncertainty is the expanded measurement uncertainty of the ID-ICP-MS method. When using the robust mean, mean or median as assigned value, the uncertainty of the assigned value was calculated using the robust standard deviation or standard deviation of the reported results [2, 4].

The uncertainty of the calculated and metrologically traceable assigned values for metals in the synthetic samples varied between 0.4 and 3 %. When using the robust mean, mean or median of the participant results as the assigned value, the uncertainties of the assigned values were between 1.1 and 14.9 % (Appendix 5).

After reporting the preliminary results the number of significant numbers of the assigned values **has been changed** for the following samples and measurands: TN3: Al, B, Sr; TY3: Al, B, Cr,

Sr; V2M: Al, Fe, Mn; LN4: Cd, Hg; LO4: Cd, Hg; A1Hg: Hg. This has minor influence to z scores in some cases, but **no influence to the performance evaluation of the participants.**

2.6.3 Standard deviation for proficiency assessment and results' evaluation

The standard deviation for proficiency assessment was estimated on the basis of the uncertainty of the assigned values, the concentrations of the measurands, the results of homogeneity and stability tests, and the long-term variation in the former proficiency tests. If the number of reported results was low (LN4: B, Hg, Sb; LC4: Hg; TY3: Sn, S_{tot}) or the deviation of the results was high (LO4: As; LN4: Sb), the standard deviation is not set, and the proficiency estimation is not given. The standard deviation for the proficiency assessment ($2\times s_{pt}$, at the 95 % confidence level) was set to 5–30 % depending on the measurement. After reporting the preliminary results **no changes have been done** for the standard deviations of the proficiency assessment values.

When the number of reported results was low (LN4: B, Hg, Sb; LC4: Hg; TY3: Sn, S_{tot}, n<6), the performance of the participant was estimated by means of D% values ('*Difference*'). D% values are calculated as the difference between the participant's result and the assigned value. D% value can be interpreted as the measurement error for the results, to the extent to which the assigned value can be considered the reference quantity value.

$$D_i\% = \frac{100\,(x_i - x_{pt})}{x_{pt}}\%\text{ , where}$$

x_i = participant's result, x_{pt} = assigned value

When using the robust mean, the mean or the median as the assigned value, the reliability was tested according to the criterion $u_{pt} / s_{pt} \leq 0.3$, where u_{pt} is the standard uncertainty of the assigned value (the expanded uncertainty of the assigned value (U_{pt}) divided by 2) and s_{pt} is the standard deviation for proficiency assessment [3]. When testing the reliability of the assigned value the criterion was mainly fulfilled and the assigned values were considered reliable.

The reliability of the standard deviation and the corresponding z score was estimated by comparing the deviation for proficiency assessment (s_{pt}) with the robust standard deviation or the standard deviation of the reported results (s_{rob}, sd) [3]. The criterion $s_{rob} / s_{pt} < 1.2$ was mainly fulfilled.

In the following cases, the criterion for the reliability of the assigned value[1] and/or for the reliability of the standard deviation for proficiency assessment[2] was not met and, therefore, the evaluation of the performance is weakened in this proficiency test:

Sample	Measurand
LN4	Al[1], Ba[1], Cd[1], Fe[1,2], Mo[1,2], Pb[1,2], Se[1], V[1]
LO4	B[1], Cd[1], Co[1,2], Ni[1,2], Se[1], V[1]
TN3	B[1], Sr[1]
TY3	B[1]
V2M	B[1]

3 Results and conclusions

3.1 Results

The terms used in the result tables are show in Appendix 6. The results and the performance of each participant are presented in Appendix 7 and the summary of the results in Table 1. The summary of the z scores is shown in Appendix 8 and summary of D% scores in Appendix 9. In Appendix 10 the z scores are shown in the ascending order. The reported results grouped by the used analytical methods with their expanded uncertainties (k=2) are presented in Appendix 10.

The robust standard deviations of the results varied from 1.8 % to 23.9 % (Table 1). The robust standard deviation of results was lower than 10 % for 80 % of the results. Standard deviations higher than 10 % apply mainly to the sludge sample (LN4/LO4). For the waste water samples the robust standard deviations of the results varied from 3.1 % to 15.5 % and for the sludge sample the variation was from 1.8 % to 23.9 % (Table 1). The robust standard deviations for waste water samples were approximately in the same range as in the previous similar proficiency test MET 10/2016 [5], where the deviations varied from 4.9 % to 17 %. For the sludge sample the robust standard deviations were somewhat lower than in the previous similar proficiency test MET 08/2015 [6], where the deviations varied from 1.1 % to 17.5 %.

Table 1. The summary of the results in the proficiency test MET 10/2017.

Measurand	Sample	Unit	Assigned value	Mean	Rob. mean	Median	s_{rob}	s_{rob} %	2 x s_{pt} %	n (all)	Acc z %
Al	A1M	mg/l	436	429	431	425	25	5.9	10	20	90
	LN4	g/kg	6.26	5.95	6.00	6.26	0.81	13.5	25	7	86
	LO4	g/kg	6.99	7.06		6.99			20	7	75
	TN3	mg/l	0.44	0.44	0.44	0.43	0.03	5.9	15	18	83
	TY3	mg/l	0.44	0.46	0.46	0.44	0.05	10.4	20	9	100
	V2M	µg/l	105	106	105	105	6	6.0	20	18	72
As	A1M	mg/l	40.9	40.4	40.2	40.5	1.3	3.3	10	17	88
	LN4	mg/kg	4.64	4.60	4.60	4.64	0.71	15.5	30	7	100
	LO4	mg/kg		4.07	4.07	4.54	1.13	27.8	-	8	-
	TN3	µg/l	80.4	80.0	80.4	79.9	3.2	4.0	15	15	93
	TY3	µg/l	83.5	82.5	82.5	83.5	2.5	3.1	15	7	100
	V2M	µg/l	7.35	7.35	7.35	7.38	0.55	7.5	20	15	100
B	LN4	mg/kg	10.3	10.3		10.8			-	4	-
	LO4	mg/kg	10.4	10.4		10.4			20	8	100
	TN3	mg/l	0.26	0.26	0.26	0.25	0.03	12.7	25	12	100
	TY3	mg/l	0.29	0.28	0.28	0.29	0.04	15.5	25	7	100
	V2M	µg/l	88.8	88.2	88.8	90.6	10.0	11.3	20	15	87
Ba	LN4	mg/kg	161	163		161			20	6	100
	LO4	mg/kg	161	163	163	161	12	7.2	20	8	100
	TN3	µg/l	24.6	24.3	24.4	24.6	1.8	7.2	15	10	90
	TY3	µg/l	25.1	25.1	25.1	25.1	0.8	3.4	15	7	100
	V2M	µg/l	35.5	35.7	35.5	36.3	1.7	4.9	15	14	100

Table 1. The summary of the results in the proficiency test MET 10/2017.

Measurand	Sample	Unit	Assigned value	Mean	Rob. mean	Median	s_{rob}	s_{rob} %	2 x s_{pt} %	n (all)	Acc z %
Ca	LN4	g/kg	37.0	37.5		37.0			15	7	86
	LO4	g/kg	37.6	38.2	38.2	37.6	4.4	11.4	20	8	100
	TN3	µg/l	66605	66605	66605	66600	2324	3.5	10	16	81
	TY3	µg/l	67578	67693		67578			15	7	86
	V2M	µg/l	32905	32871	32905	33065	1050	3.2	10	17	94
Cd	A1M	mg/l	4.82	4.83	4.83	4.76	0.28	5.8	15	19	95
	LN4	mg/kg	0.67	0.65	0.67	0.67	0.10	15.3	30	7	86
	LO4	mg/kg	0.68	0.73	0.73	0.68	0.17	23.9	30	9	75
	TN3	µg/l	44.5	44.8	44.5	44.5	1.7	3.9	15	16	100
	TY3	µg/l	46.0	45.9	45.6	46.0	1.3	2.9	15	7	100
	V2M	µg/l	5.09	5.08	5.09	5.08	0.24	4.8	15	16	100
Co	A1M	mg/l	24.4	24.0	24.1	24.0	1.2	4.9	10	18	89
	LN4	mg/kg	6.19	6.24	6.24	6.19	0.68	10.9	25	7	100
	LO4	mg/kg	6.47	6.21	6.25	6.47	1.13	18.2	25	8	88
	TN3	µg/l	57.7	57.7	57.7	57.6	5.1	8.9	20	15	100
	TY3	µg/l	60.2	59.4	58.3	60.2	5.3	9.0	15	8	88
	V2M	µg/l	4.27	4.30	4.27	4.29	0.27	6.3	15	14	93
Cr	A1M	mg/l	39.0	38.8	38.8	38.8	1.5	3.8	10	19	100
	LN4	mg/kg	29.9	29.8	29.8	29.9	3.0	9.9	20	8	100
	LO4	mg/kg	32.7	32.3	32.5	32.7	2.7	8.4	20	9	100
	TN3	µg/l	107	107	107	106	8	7.6	15	17	94
	TY3	µg/l	105	106	106	105	5	4.6	15	9	100
	V2M	µg/l	9.75	9.72	9.75	9.85	0.51	5.2	15	16	88
Cu	A1M	mg/l	40.9	40.4	40.1	40.5	2.0	5.1	10	19	84
	LN4	mg/kg	385	393	393	385	26	6.6	20	9	100
	LO4	mg/kg	392	392	392	392	13	3.2	20	9	100
	TN3	µg/l	77.1	76.6	77.1	77.1	4.8	6.2	15	18	94
	TY3	µg/l	79.6	78.3	78.6	79.6	4.8	6.2	15	8	100
	V2M	µg/l	9.86	9.95	9.86	9.85	0.86	8.8	20	18	78
Drw	L4M	%	93.8	93.7	93.8	93.8	1.7	1.8	5	15	
Fe	A1M	mg/l	515	514	513	516	29	5.7	10	20	90
	LN4	g/kg	115	118		115			20	8	50
	LO4	g/kg	118	119	121	118	7	5.8	20	9	100
	TN3	µg/l	521	520	521	526	36	6.9	15	20	90
	TY3	µg/l	536	535	537	536	34	6.3	15	9	100
	V2M	mg/l	0.79	0.79	0.79	0.79	0.05	6.3	15	18	72
Hg	A1Hg	µg/l	0.67	0.66	0.66	0.67	0.06	9.3	20	16	75
	LC4	mg/kg		0.476		0.476			-	2	-
	LN4	mg/kg	0.53	0.53		0.54			-	5	-
	LO4	mg/kg	0.52	0.52		0.52			20	9	67
	T3Hg	µg/l	2.67	2.60	2.60	2.58	0.32	12.4	20	18	94
	V2Hg	µg/l	2.16	2.14	2.17	2.11	0.23	10.8	20	16	88
Mg	LN4	g/kg	3.99	4.03	4.03	3.99	0.36	8.9	20	7	100
	LO4	g/kg	4.09	4.10	4.10	4.09	0.23	5.6	15	8	100
	TN3	µg/l	21309	21253	21309	21395	770	3.6	10	15	93
	TY3	µg/l	22200	21911		22200			15	7	86
	V2M	µg/l	8035	8061	8035	8020	268	3.3	10	17	94

Table 1. The summary of the results in the proficiency test MET 10/2017.

Measurand	Sample	Unit	Assigned value	Mean	Rob. mean	Median	s_{rob}	s_{rob} %	2 x s_{pt} %	n (all)	Acc z %
Mn	A1M	mg/l	297	301	301	301	15	5.0	10	20	100
	LN4	mg/kg	330	330	330	330	40	12.0	25	8	100
	LO4	mg/kg	332	332	332	330	14	4.3	20	8	100
	TN3	µg/l	138	140	138	140	7	4.8	10	17	76
	TY3	µg/l	138	137	137	138	10	7.1	15	8	100
	V2M	mg/l	0.20	0.20	0.20	0.20	0.01	4.9	15	18	78
Mo	LN4	mg/kg	5.94	5.94	5.94	6.34	1.30	21.9	25	8	88
	LO4	mg/kg	6.18	6.18	6.20	6.25	0.85	13.6	25	9	100
	TN3	mg/l	1.68	1.68	1.68	1.68	0.08	4.6	10	14	93
	TY3	mg/l	1.75	1.76	1.76	1.75	0.11	6.2	15	7	100
	V2M	µg/l	26.9	27.0	26.9	26.9	1.3	4.9	15	15	93
Ni	A1M	mg/l	47.5	47.1	47.1	47.0	2.7	5.8	10	20	95
	LN4	mg/kg	21.6	21.6	21.6	21.6	1.9	9.0	20	8	100
	LO4	mg/kg	22.5	22.3	22.4	22.5	2.7	11.9	25	9	78
	TN3	µg/l	106	106	106	105	9	9.0	15	18	89
	TY3	µg/l	109	109	109	109	7	6.1	15	7	100
	V2M	µg/l	9.64	9.61	9.64	9.67	0.40	4.1	15	15	93
N_{tot}	L4M	g/kg	28.2	27.6	27.6	28.2	2.0	7.4	15	10	100
Pb	A1M	mg/l	45.5	45.3	45.2	44.8	2.5	5.6	10	19	89
	LN4	mg/kg	17.7	19.4	19.4	17.7	3.5	18.3	25	7	71
	LO4	mg/kg	18.1	18.1	18.6	18.1	2.3	12.5	25	9	89
	TN3	µg/l	90.6	85.3	84.6	83.9	6.5	7.7	15	15	73
	TY3	µg/l	88.2	87.7	87.7	88.2	4.7	5.4	15	8	100
	V2M	µg/l	9.34	8.64	8.71	8.58	0.55	6.4	15	15	86
P_{tot}	L4M	g/kg	36.2	36.2	36.2	35.7	2.1	5.7	15	14	71
Sb	LN4	mg/kg	9.56	9.68		9.56			-	4	-
	LO4	mg/kg	13.5	14.0	13.7	13.5	1.9	13.9	30	10	80
	TN3	µg/l	85.5	85.5	85.5	85.7	4.9	5.8	15	12	100
	TY3	µg/l	88.3	86.7	87.3	88.3	3.9	4.5	15	7	100
	V2M	µg/l	6.28	6.34	6.28	6.32	0.45	7.1	15	14	92
Se	A1M	mg/l	41.6	41.6	41.6	41.7	1.8	4.4	10	15	87
	LN4	mg/kg	12.8	12.2	12.3	12.8	1.5	12.1	25	7	86
	LO4	mg/kg	12.3	11.7	11.8	12.3	2.1	18.0	30	8	88
	TN3	µg/l	52.8	52.6	52.8	52.4	3.8	7.1	15	12	92
	TY3	µg/l	54.3	54.3	53.8	54.3	2.1	3.9	15	7	100
	V2M	µg/l	6.41	6.37	6.41	6.41	0.41	6.4	15	14	92
Sn	LN4	mg/kg		21.4		21.3			-	3	-
	LO4	mg/kg	27.8	28.2	28.1	27.8	2.3	8.3	20	8	88
	TN3	µg/l	18.5	18.1	18.1	18.5	1.7	9.3	20	8	100
	TY3	µg/l	17.3	17.5		17.3			-	5	-
	V2M	µg/l	2.71	2.80	2.78	2.71	0.24	8.5	20	11	78
Sr	LN4	mg/kg	97.3	98.3		97.3			20	6	100
	LO4	mg/kg	98.0	98.0	98.6	98.0	7.4	7.5	20	7	100
	TN3	mg/l	0.22	0.22	0.22	0.22	0.02	8.8	15	9	89
	TY3	mg/l	0.22	0.22		0.22			15	6	100
	V2M	µg/l	91.7	91.7	91.7	92.2	3.9	4.2	10	13	92

Table 1. The summary of the results in the proficiency test MET 10/2017.

Measurand	Sample	Unit	Assigned value	Mean	Rob. mean	Median	s_{rob}	s_{rob} %	2 x s_{pt} %	n (all)	Acc z %
S_{tot}	L4M	g/kg	11.1	11.1	11.1	11.0	1.0	8.6	15	12	92
	TN3	mg/l	168	168	169	170	5	2.7	10	11	82
	TY3	mg/l	170	168		170			-	6	-
	V2M	mg/l	31.7	31.6	31.7	31.8	0.8	2.6	10	15	87
V	A1M	mg/l	50.8	50.6	50.6	50.4	2.1	4.2	10	14	100
	LN4	mg/kg	28.2	28.5		28.2			15	7	86
	LO4	mg/kg	30.0	30.4	30.4	30.0	3.5	11.6	20	7	88
	TN3	µg/l	114	114	114	113	8	6.9	15	12	92
	TY3	µg/l	115	115	115	115	6	5.1	15	7	100
	V2M	µg/l	8.48	8.52	8.48	8.39	0.67	7.9	20	14	100
Zn	A1M	mg/l	281	282	282	279	19	6.7	10	19	90
	LN4	mg/kg	593	599	600	593	38	6.3	15	9	100
	LO4	mg/kg	595	588	588	595	35	5.9	15	8	100
	TN3	µg/l	119	119	119	120	7	5.8	15	19	84
	TY3	µg/l	121	122	119	121	17	14.3	15	9	70
	V2M	µg/l	52.0	52.0	52.0	52.4	2.8	5.3	15	16	82

Rob. mean: the robust mean, s_{rob}: the robust standard deviation, s_{rob} %: the robust standard deviation as percent, $2 \times s_{pt}$ %: the total standard deviation for proficiency assessment at the 95 % confidence level, Acc z %: the results (%), where $|z| \leq 2$, n(all): the total number of the participants.

3.2 Analytical methods

The participants were allowed to use different analytical methods for the measurements in the PT. The used analytical methods and results of the participants grouped by methods are shown in more detail in Appendix 11. The statistical comparison of the analytical methods was possible for the data where the number of the results was ≥ 5. The statistically significant differences noticed from the results are shown in Appendix 12.

Effect of sample pretreatment on elemental concentrations in waste waters

Elements in waste water were mainly measured from acidified samples without sample pretreatment with the exception of the industrial waste water sample (TN3/TY3). Overall half of the participants measured the acidified industrial waste water without sample pretreatment (TN3), and the other participants measured the industrial waste water after acid digestion (TY3, Table 1). The results were evaluated separately.

The difference between the average concentrations of elements measured by different sample pretreatment methods was tested using the t-test. Statistically significant difference was observed for arsenic analyses. The approach with no pretreatment gave significantly lower results compared to the pretreatment with acid digestion (Appendix 12). For the unfiltered waste water sample the results are expected, acid digestion should give similar or higher results than without digestion.

Effect of sample pretreatment on elemental concentrations in sludge sample

Elements in the sludge sample were measured mainly after acid digestion (LN4/LO4). Aqua regia digestion (LO4) was slightly more often used than nitric acid digestion (LN4, Table 1). The results of these were evaluated separately. Both treatments can be considered as partial

digestions only. For total element content other acid mixtures including hydrofluoric acid must be used.

The difference between the average concentrations of elements measured by different acid digestions was tested using the t-test. Statistically significant difference was observed for aluminium analyses. Nitric acid digestion gave significantly lower results compared to the aqua regia digestion approach (Appendix 12).

The digestion method in general can highly influence the recoveries depending on digestion temperature and hold times as can the sample weight and acid amount ratio.

Effect of measurement methods on elemental results

The most commonly used analytical techniques were ICP-OES and ICP-MS. Only few participants (1-2) used FAAS or GAAS techniques for some measurands. Hydride generation ICP-OES was used by one participant. In nitrogen measurements mainly N-Kjeldahl or similar method was used and only one participant used CHN analyzer (Appendix 11). Dry weight (Drw) was measured using heating chamber, moisture analyzer or based on the standard methods as SFS 3008, ISO 11465, and EN 15169.

The difference between the average concentrations of metals measured by different measurement methods was tested using the t-test. Statistically significant differences were observed for Al and Zn analysis in the synthetic sample A1M. For these measurands the ICP-MS technique gave lower results compared to the ICP-OES result (Appendix 12). Further, statistically significant difference was also found from Mo analysis of the industrial waste water sample TN3. There ICP-OES gave smaller results than ICP-MS technique (Appendix 12).

ICP-MS is in most cases the technique of preference due to its superior detection capabilities compared to other techniques when low concentrations are to be measured. However, in this round the synthetic sample A1M had high concentrations, which should be relatively easy to measure with both ICP techniques. Results by ICP-MS may be affected by high dilution factors, which will introduce an uncertainty component not usually present.

As a general note, a low recovery may be an indication of loss of measurand which can occur during sample pretreatment (e.g. volatilization during acid digestion) or measurement (e.g. GAAS analysis). It may also be caused by incorrect background correction (ICP-OES) or matrix effects.

Recoveries that are too high may be caused by spectral interferences (overlapping wavelengths in emission spectrometry, polyatomic or isobaric interferences in mass spectrometry), matrix effects or contamination.

Matrix effects can often be overcome by matrix matching the calibration standards, however this is often difficult with environmental samples since the elemental concentrations vary a lot even within the same sample type.

Effect of measurement methods on mercury results

For the analysis of mercury, ICP-MS was the most often used method of analysis. That was followed by CV-AFS and CV-AAS. Other used methods were CV-ICP-MS, CV-ICP-OES, ICP-OES and direct combustion (Appendix 11). No significant differences between the used measuring methods were found.

For the sludge sample, aqua regia digestion (LO4) was more often used than nitric acid digestion (LN4). The number of results was too low (n<6) for performance evaluation of the sample LN4.

As for the other metal determinations, also mercury results are affected by digestion procedures used (acids and oxidation reagents used, their concentration, amounts and purities, digestion temperature and time). For water samples hydrochloric acid is recommended to be used for sample preservation and BrCl is recommended to be used for oxidation of mercury species.

Analytical techniques do not have so much effect on the results, but the fact is that for example when using CV-AFS lower detection limits can be achieved compared to the use of CV-AAS. CV-ICP-MS technique is known to have very competent detection limits as well.

3.3 Uncertainties of the results

At maximum 70 % of the participants reported the expanded uncertainties (k=2) with their results for at least some of their results (Table 2, Appendices 11, 13). The range of the reported uncertainties varied between the measurements and the sample types. As can be seen in Table 2, many of the participants have clearly under or overestimated their expanded (k=2) measurement uncertainties. Expanded measurement uncertainty below 5 % is not common for routine laboratories. Also measurement uncertainty over 50 % should not exist, unless the measured concentration is near to the limit of quantification.

In order to promote the enhancement of environmental measurements' quality standards and traceability, the national quality recommendations for data entered into water quality registers have been published in Finland [7]. The recommendations for measurement uncertainties for most of the tested measurands in waste water are 20 %. In this proficiency test some of the participants had their measurement uncertainties within these limits, while some did not achieve them. Harmonization of the uncertainties estimation should be continued.

Several approaches were used for estimating of measurement uncertainty (Appendix 13). The most used approach was based on the internal quality data with sample replicates approach, followed by the based on the data obtained from method validation. Five participants used MUkit measurement uncertainty software for the estimation of their uncertainties. The free software is available on the webpage: www.syke.fi/envical/en [8]. Generally, the used approach for estimating measurement uncertainty did not make definite impact on the uncertainty estimates.

Table 2. The range of the expanded measurement uncertainties (k=2, U_i%) reported by the participants.

Measurand	A1M / A1Hg %	LC4 / LN4 / LO4 / L4M %	V2M / V2Hg %	TN3 / T3Hg %	TY3 %
Al	5-30	17-40	5-30	3-25	10-30
As	4-30	17-35	10-50	4-25	10-30
B	-	20-56	10-50	5-50	15-30
Ba	-	15-30	10-50	10-30	10-20
Ca	-	10-35	5-30	5-20	6-30
Cd	5-30	20-50	10-50	10-33	15-33
Co	5-30	15-50	10-50	5-20	15-30
Cr	5-30	17-30	10-50	8-25	15-30
Cu	5-30	10-30	10-50	10-40	15-34
Drw	-	2-10	-	-	-
Fe	5-33	10-30	3-33	3-33	10-33
Hg	10-46	10-50	10-40	9-40	-
Mg	-	10-40	5-30	5-20	4.9-30
Mn	10-30	10-30	4-30	4-20	11-30
Mo	-	18-50	10-50	9-20	12-35
Ni	5-30	15-35	10-50	10-25	15-30
N_{tot}	-	10-30	-	-	-
Pb	10-30	15-35	10-50	10-50	15-30
P_{tot}	-	10-30	-	-	-
Sb	-	20-35	8-50	8-26	12-30
Se	10-30	20-50	12-50	15-29	15-30
Sn	-	20-35	10-50	15-20	15-50
Sr	-	15-35	10-30	5-20	15-30
S_{tot}	-	15-35	10-30	5-20	10-30
V	8-30	17-30	8-50	8-20	13-30
Zn	5-30	10-31	10-30	9-29	10-30

4 Evaluation of the results

The evaluation of the participants was based on the z scores, which were calculated using the assigned values and the standard deviation for the proficiency assessment (Appendix 6). The z scores were interpreted as follows:

Criteria	Performance
$\lvert z \rvert \leq 2$	Satisfactory
$2 < \lvert z \rvert < 3$	Questionable
$\lvert z \rvert \geq 3$	Unsatisfactory

In total, 91 % of the results were satisfactory when total deviation of 5–30 % from the assigned values was accepted. Altogether 67 % of the participants used accredited analytical methods at least for a part of the measurements and 94 % of their results were satisfactory. For some measurands D% values were given and for 63 % of participants the D% values were lower than 10 % and for 92 % lower than 20 % (Appendix 9). The summary of the performance evaluation and comparison to the previous performance is presented in Table 3. In the previous similar PT, Proftest SYKE MET 08/2015 [6], the performance was satisfactory for 90 % of the all participants when standard deviation of 5–30 % from the assigned values were accepted.

Table 3. Summary of the performance evaluation in the proficiency test MET 10/2017.

Sample	Satisfactory results (%)	Accepted deviation from the assigned value (%)	Remarks
A1M / A1Hg	92 / 75	10-20	- Difficulties in measurement for Hg < 80 % satisfactory results. - In the MET 10/2016 the performance was satisfactory for 92/75 % of the results [5].
L4M	91	5-15	- Difficulties in measurement for P_{tot} < 80 % satisfactory results. - In the MET 08/2015 the performance was satisfactory for 88 % of the results [6].
LN4 / LO4	91 / 82	15-30	- Only approximate assessment for: Co, Fe, Mo, Ni, Pb - High uncertainty of the assigned value: Al, B, Ba, Cd, Se, V - Due to low number of results LN4: B, Hg, Sb and LC4: Hg were not evaluated, but D % values are given. - Due to high deviation of the results LN4: Sb and LO4:As were not evaluated - Some difficulties in measurement for Al, Cd, Fe, Hg, Ni, Pb < 80 % satisfactory results. - In the MET 08/2015 the performance was satisfactory for 96/94 % of the results [6].
TN3 / T3Hg	90 / 94	10-25	- High uncertainty of the assigned value: B, Sr - Difficulties in measurements for Mn, Pb < 80 % satisfactory results. - In the MET 10/2016 the performance was satisfactory for 92/76 % of the results when accepting deviation of 15-20 % from the assigned value [5].
TY3	96	15-25	- High uncertainty of the assigned value: B - Due to low number of results TY3: Sn, S_{tot} were not evaluated, but D % values are given. - Difficulties in measurements for Zn < 80 % satisfactory results. - In the MET 10/2016 the performance was satisfactory for 95 % of the results when accepting deviation of 15-20 % from the assigned value [5].
V2M / V2Hg	89 / 88	10-20	- High uncertainty of the assigned value: B - Difficulties in measurements for Al, Cu, Fe, Mn, Sn < 80 % satisfactory results. - In the MET 10/2016 the performance was satisfactory for 94/88 % of the results when accepting deviation of 15-20 % from the assigned value [5].

In average, the satisfactory results varied between 75 % and 96 % for the tested sample types (Table 3). The number of satisfactory results in the synthetic sample A1M was the lowest for Hg 75 %. The findings are similar than in the previous similar proficiency test in 2016 [5].

For many measurands the sludge sample turned out to be challenging and the number of participants analysing the sample was low. The evaluation of the sludge sample is only approximate for some measurands due to weakness of the reliability of the assigned value, the standard deviation for assessment and the reliability of the corresponding z score (Table 3). For the sludge sample, standard deviation of 5–30 % from the assigned value was accepted. 91 % of the results obtained after nitric acid digestion (LN4) were satisfactory when standard

deviation of 15–30 % from the assigned value was accepted. Further, 82 % of the results obtained after aqua regia digestion (LO4) were satisfactory when standard deviation of 15–30 % from the assigned value was accepted. In the previous proficiency test for sludge sample, Proftest SYKE MET 08/2015, 96 % of results were satisfactory after nitric acid digestion (LN4), when the deviation of 15–30 % from the assigned value was accepted [6]. There, for the sludge sample after aqua regia digestion (LO4), 94 % of the results were satisfactory and the standard deviation of 15–30 % from the assigned value was accepted [6]. For dry weight of the sludge sample L4M, all the results were satisfactory when the accepted standard deviation from the assigned value was 5 %. For N_{tot}, P_{tot} and S_{tot} from the sample L4M the accepted standard deviation from the assigned value was 15 % and 100, 71 and 92 % of the results were satisfactory, respectively. For these measurands 89, 80 and 83 % of the results were satisfactory, respectively, with the same accepted standard deviation from the assigned value in the previous proficiency test MET 08/2015 [6].

For the industrial waste water sample (TN3/TY3 and T3Hg) 93 % of the results were satisfactory, when deviation of 10–25 % from the assigned value was accepted. For B, Cd, Co, Sb, and Sn in the sample TN3, and for Al, As, B, Ba, Cd, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, Sr, and V in the sample TY3 all the results were satisfactory (Table 1). For the municipal waste water sample V2M all results for As, Ba, Cd, and V were satisfactory. For Hg in the waste water T3Hg the number of satisfactory results (94 %) was higher than in MET 10/2016, when 76 % of results were satisfactory with the same accepted standard deviation (20 %) from the assigned value [5].

5 Summary

Proftest SYKE carried out the proficiency test (PT) for elemental analysis of waste waters and sludge in October 2017 (MET 10/2017). The measurands for the synthetic samples were: Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, V, and Zn. These measurands were also analysed from the waste water samples as well as measurands B, Ba, Ca, Mg, Mo, Sb, Sn, Sr, and S_{tot}. In addition to the aforementioned, also measurands N_{tot}, P_{tot}, and dry weight were analysed from the sludge sample. In total 26 laboratories participated in the PT.

For the synthetic sample A1M the NIST traceable calculated concentrations were used as the assigned values for all measurands. For Hg samples as well as for other Pb samples (A1Hg, T3Hg, V2Hg, TN3, V2M, respectively) the assigned values based on ID-ICP-MS results were used. For other samples and measurements the robust mean, mean or median value was used as the assigned value. The expanded uncertainty for the assigned value was estimated at the 95 % confidence level and it was between 0.4 and 3 % for the calculated and metrologically traceable assigned values and for assigned values based on the robust mean, mean or median it was between 1.1–14.9 %.

The evaluation of the performance was based on the z scores, which were calculated using the standard deviation for proficiency assessment at 95 % confidence level. In this proficiency test

91 % of the data was regarded to be satisfactory when the results were accepted to deviate from the assigned value 5 to 30 %. About 67 % of the participants used accredited methods and 94 % of their results were satisfactory. For results with low number of participants D % scores were calculated. For 63 % of the participants the D % scores were lower than 10 % and for 92 % of the participants lower than 20 %.

6 Summary in Finnish

Proftest SYKE järjesti pätevyyskokeen jätevesiä sekä lietettä analysoiville laboratorioille lokakuussa 2017 (MET 10/2017). Pätevyyskokeessa määritettiin synteettisistä näytteistä metallit Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, V ja Zn. Jätevesinäytteistä määritettiin edellä mainittujen lisäksi B, Ba, Ca, Mg, Mo, Sb, Sn, Sr ja S_{tot}. Lietenäytteestä määritettiin näiden lisäksi myös N_{tot}, P_{tot} sekä kuivapaino. Pätevyyskokeeseen osallistui yhteensä 26 laboratoriota.

Mittaussuureen vertailuarvona käytettiin laskennallista pitoisuutta, osallistujien tulosten robustia keskiarvoa, keskiarvoa tai mediaania. Lyijylle ja elohopealle käytettiin metrologisesti jäljitettävää vertailuarvoa osassa testinäytteistä. Vertailuarvolle laskettiin epävarmuus 95 % luottamusvälillä. Vertailuarvon laajennettu epävarmuus oli 0,4 – 3 % laskennallista tai metrologisesti jäljitettävää pitoisuutta vertailuarvona käytettäessä ja muilla välillä 1,1 – 14,9 %.

Pätevyyden arviointi tehtiin z-arvon avulla ja tulosten sallittiin poiketa vertailuarvosta 5–30 %. Koko aineistossa hyväksyttäviä tuloksia oli 91 %. Noin 67 % osallistujista käytti akkreditoituja määritysmenetelmiä ja näistä tuloksista oli hyväksyttäviä 94 %. Testisuureille ja näytteille, joilla osallistujatuloksia oli vähän, laskettiin D%-arvo. 63 % osallistujista D%-arvo oli alhaisempi kuin 10 % ja 92 % osallistujista alhaisempi kuin 20 %.

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APPENDIX 1: Participants in the proficiency test

Country	Participant
Denmark	Eurofins Miljø A/S, Vejen, Denmark
Finland	Ahma ympäristö Oy, Oulu
	Boliden Harjavalta Oy
	Boliden Kokkola Oy
	Eurofins Environment Testing Finland Oy, Lahti
	Fortum Waste Solutions Oy, Riihimäki
	Freeport Cobalt Oy
	Hortilab Ab Oy
	Huntsman P&A Finland Oy, Analyyttinen laboratorio Pori
	Kokemäenjoen vesistön vesiensuojeluyhdistys ry, Tampere
	Kymen Ympäristölaboratorio Oy
	Lounais-Suomen vesi- ja ympäristötukimus Oy, Turku
	Metropolilab Oy
	Nablabs Oy / Jyväskylä
	Norilsk Nickel Harjavalta Oy
	Novalab Oy
	Outokumpu Stainless Oy, Tutkimuskeskus, Tornio
	Savo-Karjalan Ympäristötutkimus Oy, Kuopio
	SGS Finland Oy, Kotka
	SSAB Europe Oy, Analyysilaboratorio, Hämeenlinna
	SSAB Europe Raahe, Raahe
	SYKE Ympäristökemia Helsinki
	UPM Tutkimuskeskus, Lappeenranta
Luxembourg	Laboratoire National de Santé
Sweden	ACES, Stockholm University
	INOVYN Sverige Ab

APPENDIX 2: Preparation of the samples

The synthetic sample A1M was prepared by diluting the NIST traceable certified reference material produced by Inorganic Ventures. The synthetic sample A1Hg was prepared by diluting the NIST traceable AccuTrace™ Reference Standard produced by AccuStandard, Inc. The water samples V2M, T3M (TN3/TY3), V2Hg and T3Hg were prepared by adding some separate metal solutions (Merck CertiPUR® or AccuStandard) into the original water sample, if the original concentration was not high enough.

Measurand		A1M mg/l	V2M µg/l	TN3/TY3 µg/l	LN4/LO4 mg/kg	Measurand		A1M mg/l	V2M µg/l	TN3/TY3 µg/l	LN4/LO4 mg/kg
Al	Original	6 600	5	310	3/5.0 g/kg	Cu	Original	620	4.85	9.5	202
	Dilution	15.2	-	-	-		Dilution	15.2	-	-	-
	Addition	-	100	100	-		Addition	-	5	70	-
	Ass. value	436	105.3	440/443	6.26/6.99		Ass. value	40.9	9.86	77.1/79.6	385/392
As	Original	620	0.2	1.9	2.4	Fe	Original	7 800	200	26	47/90 g/kg
	Dilution	15.2	-	-	-		Dilution	15.2	-	-	-
	Addition	-	7	80	-		Addition	-	600	500	-
	Ass. value	40.9	7.35	80.4/83.5	4.64/-		Ass. value	515	794	521/536	115/118
B	Original	-	110	300	5.3	Mg	Original	-	8 200	20 000	2.20 g/kg
	Dilution	-	-	-	-		Dilution	-	-	-	-
	Addition	-	-	-	-		Addition	-	-	-	-
	Ass. value	-	88.8	256/292	10.3/10.4		Ass. value	-	8 035	21 309/ 22 200	3.99/4.09
Ba	Original	-	5.8	23	91	Mn	Original	4 500	210	36	184
	Dilution	-	-	-	-		Dilution	15.2	-	-	-
	Addition	-	30	-	-		Addition	-	-	100	-
	Ass. value	-	35.5	24.6/25.1	161/161		Ass. value	297	200	138/138	330/332
Ca	Original	-	33 300	62 200	20.0 g/kg	Mo	Original	-	1.7	1 700	3.2/5.6
	Dilution	-	-	-	-		Dilution	-	-	-	-
	Addition	-	-	-	-		Addition	-	25	-	-
	Ass. value	-	32 905	66 605/ 67 578	37.0/37.6		Ass. value	-	26.9	1 680/ 1 750	5.94/6.18
Cd	Original	73	0.014	0.27	0.38	Ni	Original	720	11	12	12
	Dilution	15.2	-	-	-		Dilution	15.2	-	-	-
	Addition	-	5	45	-		Addition	-	-	100	-
	Ass. value	4.82	5.09	44.5/46.0	0.670/ 0.678		Ass. value	47.5	9.64	106/109	21.6/22.5
Co	Original	370	4.9	0.96	3.3	N_{tot}	Original	-	-	-	29 g/kg
	Dilution	15.2	-	-	-		Dilution	-	-	-	-
	Addition	-	-	60	-		Addition	-	-	-	-
	Ass. value	24.4	4.27	57.7/60.2	6.19/6.47		Ass. value	-	-	-	28.2
Cr	Original	590	0.23	75	17	Pb	Original	690	0.05	0.063	10
	Dilution	15.2	-	-	-		Dilution	15.2	-	-	-
	Addition	-	9	35	-		Addition	-	9	90	-
	Ass. value	39.0	9.75	107/105	29.9/32.7		Ass. value	45.5	9.34	90.6/88.2	17.7/18.1

Measurand		A1M mg/l	V2M µg/l	TN3/TY3 µg/l	LN4/IO4 mg/kg	Measurand		A1M mg/l	V2M µg/l	TN3/TY3 µg/l	LN4/LO4 mg/kg
P_{tot}	Original	-	-	-	12/27	S_{tot}	Original	-	32 000	180 000	5.1/9.1 g/kg
	Dilution	-	-	-	g/kg		Dilution	-	-	-	-
	Addition	-	-	-	-		Addition	-	-	-	-
	Ass.	-	-	-	-		Ass.	-	31 700	168 000/	11.1/-
	value				36.2		value			170 000	
Sb	Original	-	0.30	7.2	13/-	V	Original	770	0.16	6.3	15
	Dilution	-	-	-	-		Dilution	15.2	-	-	-
	Addition	-	6	80	13		Addition	-	8	110	-
	Ass.	-	6.28	85.5/88.3	9.56/13.5		Ass.	50.8	8.48	114/115	28.2/30.0
	value						value				
Se	Original	630	0.30	3.1	11	Zn	Original	4 250	56	110	306
	Dilution	15.2	-	-	-		Dilution	15.2	-	-	-
	Addition	-	6	50	9		Addition	-	-	-	-
	Ass.	41.6	6.41	52.8/54.3	12.8/12.3		Ass.	281	52.0	119/121	593/595
	value						value				
Sn	Original	-	0	0	25/25	Measurand		A1Hg µg/l	V2Hg µg/l	T3Hg µg/l	LN4/LO4/ LC4 mg/kg
	Dilution	-	-	-	-						
	Addition	-	2.8	18.7	6/6						
	Ass.	-	2.71	18.5/17.3	21.4/28.2						
	value										
Sr	Original	-	93	210	57	Hg	Original	-	0.002	0.004	0.44
	Dilution	-	-	-	-		Dilution	-	-	-	-
	Addition	-	-	-	-		Addition	0.67	2.33	2.67	-
	Ass.	-	91.7	216/224	97.3/98.0		Ass.	0.665	2.16	2.67	0.534/0.518
	value						value				-

Original = the original concentration
Dilution = the ratio of dilution
Addition = the addition concentration
Ass. value = the assigned value

APPENDIX 3: Homogeneity of the samples

Homogeneity was tested from duplicate measurements of selected measurands from three samples of each sample types (see table below).

Criteria for homogeneity

$\mathbf{s_{anal}/s_{pt}<0.5}$ and $\mathbf{s_{sam}^2<c}$, where

s_{pt} = standard deviation for proficiency assessment
s_{anal} = analytical deviation, standard deviation of the results within sub samples
s_{sam} = between-sample deviation, standard deviation of the results between sub samples

$c = F1 \times s_{all}^2 + F2 \times s_{anal}^2$, where
$s_{all}^2 = (0.3 \times s_{pt})^2$

F1 and F2 are constants of F distribution derived from the standard statistical tables for the tested number of samples [2, 3].

Measurement/ sample	Concentration [µg/l] [mg/kg]	n	s_{pt} %	s_{pt}	s_{anal}	s_{anal}/s_{pt}	Is $s_{anal}/s_{pt}<0.5$?	s_{sam}^2	c	Is $s_{sam}^2<c$?
Cd/V2M	5.07	3	2.0	0.10	0.05	0.46	Yes	0.0008	0.01	Yes
Cr/V2M	9.56	3	2.0	0.19	0.09	0.45	Yes	0	0.04	Yes
Cu/V2M	9.97	3	1.0	0.10	0.03	0.28	Yes	0.003	0.006	Yes
Pb/V2M	8.86	3	1.0	0.09	0.04	0.49	Yes	0.002	0.01	Yes
Se/V2M	6.64	3	3.5	0.23	0.11	0.48	Yes	0	0.07	Yes
Zn/V2M	52.7	3	2.0	1.05	0.51	0.49	Yes	0.03	1.43	Yes
Cd/T3M	44.9	3	1.5	0.67	0.32	0.47	Yes	0	0.55	Yes
Cr/T3M	106	3	1.5	1.59	0.57	0.36	Yes	0	2.10	Yes
Cu/T3M	77.6	3	1.0	0.78	0.30	0.39	Yes	0.04	0.55	Yes
Pb/T3M	85.0	3	1.5	1.27	0.51	0.40	Yes	0	1.57	Yes
Se/T3M	53.0	3	2.0	1.06	0.47	0.45	Yes	0	1.26	Yes
Zn/T3M	123	3	2.0	2.45	1.10	0.45	Yes	0.11	6.81	Yes
Sb/L4M	18.5	3	7,5	1.39	0.68	0.49	Yes	0	2.48	Yes
Se/L4M	12.6	3	4.5	0.56	0.28	0.49	Yes	0	0.41	Yes
Sn/L4M	38.8	3	9.0	3.50	1.65	0.47	Yes	0	14.9	Yes
Zn/L4M	38.8	3	9	3.50	1.65	0.47	Yes	0	14.9	Yes
ID-ICP-MS testing										
Hg/V2Hg*	2.16	3	2.0	0.04	0.02	0.41	Yes	0	0.002	Yes
Hg/T3Hg*	2.67	3	1.0	0.03	0.009	0.34	Yes	0	0.0005	Yes
Pb/V2M*	9.30	3	1.0	0.09	0.04	0.44	Yes	0	0.009	Yes
Pb/T3M*	90.5	3	2.5	2.26	0.93	0.41	Yes	0	5.11	Yes

*) result based on the ID-ICP-MS measurement

Conclusion: The criteria were fulfilled for the tested measurands and the samples were regarded as homogenous

APPENDIX 4: Feedback from the proficiency test

FEEDBACK FROM THE PARTICIPANTS

Participant	Comments on technical excecution	Action / Proftest SYKE
4, 19, 24	Participants received the samples within one day or two days after the estimated delivery day.	According to the distributor's tracking system the samples arrived to the participants on time. The provider recommends to check the internal package delivery procedures.
20	The participant feels that reporting the results via ProftestWEB is difficult and time consuming. Due to the system, they have reported erroneously some of their results (in wrong unit), and thus they get some high z scores. The participant wishes improvements to the electronic results' reporting, for example a possibility to copy the results from Excel sheets to the reporting system.	The provider is aware that the result reporting via the ProftestWEB is challenging for the large proficiency tests like the current PT. Before the current PT improvements had been introduced to ProftestWEB, including e.g. the memory effect for the method selection and the bottle number. To introduce copying possibility from the participant's Excel sheets is very demanding development request, and it will be very costly causing a need to increase the participation fees. Thus, at this moment, it will not be a cost effective way to develop ProftestWEB. Based on the data evaluation only part of the high z scores could be solved by the unit error. The results for S_{tot} in samples TN3 and V2M would be satisfactory if reported as divided with factor 1000. For the other high z scores, the results would be unsatisfactory also when divided or multiplied with factor 1000.

Participant	Comments to the results	Action / Proftest SYKE
1	The participant informed that they reported some results erroneously. The corrected results were: V2M Fe 0.800 mg/l (unit error) V2M Mn 0.210 mg/l (unit error) A1M As 39.0 mg/l (the result was forgotten to be reported)	The results were outliers in the statistical treatment, and thus did not affect the performance evaluation. If the results had been reported correctly, the results would have been satisfactory. The participant can re-calculate the z scores according to the Guide for participants [4].
5	The result for Al was reported in the wrong unit. The correct value for TN3 was 0.36 mg/l.	The result was outlier in the statistical treatment, and thus did not affect the performance evaluation. If the result had been reported correctly, the result would have been questionable. The participant can re-calculate the z score according to the Guide for participants [4].
15	The participant reported the result for P_{tot} in the wrong unit. The corrected result was: Sample L4M: 44.4 g/kg.	The result was outlier in the statistical treatment, and thus did not affect the performance evaluation. If the result had been reported correctly, the result would have been unsatisfactory. The participant can re-calculate the z score according to the Guide for participants [4].

Participant	Comments to the results	Action / Proftest SYKE
19	The result for Mo was reported in the wrong unit. The correct value for TN3 was 1.736 mg/l.	The result was outlier in the statistical treatment, and thus did not affect the performance evaluation. If the result had been reported correctly, the result would have been satisfactory. The participant can re-calculate the z score according to the Guide for participants [4].

FEEDBACK TO THE PARTICIPANTS

Participant	Comments
All	Due to transportation issues of the base solution the sample A1M contained only 13 measurands. Further, due to the transportation issues, the sample preparation was fastened causing the sample having 1000 times higher measurand concentrations than was foreseen. This unfortunate situation was informed to the participants and they were requested to make necessary dilutions for the samples. The results were requested to be reported in unit mg/l (formerly µg/l). The organizer apologizes any possible inconvenience.
15	The participant reported below detection limit value (< 0.3 mg/kg) for Cd in the sample LO4, though the tested concentration was high enough to be measured (assigned value 0.68 mg/kg). The provider recommends the participant to validate their detection limit value.

APPENDIX 5: Evaluation of the assigned values and their uncertainties

Measurand	Sample	Unit	Assigned value	U_{pt}	U_{pt}, %	Evaluation method of assigned value	u_{pt}/s_{pt}
Al	A1M	mg/l	436	2	0.5	Calculated value	0.05
	LN4	g/kg	6.26	0.65	10.4	Median	0.42
	LO4	g/kg	6.99	0.52	7.5	Median	0.38
	TN3	mg/l	0.44	0.02	3.7	Robust mean	0.25
	TY3	mg/l	0.44	0.03	6.1	Median	0.31
	V2M	µg/l	105	4	3.8	Robust mean	0.19
As	A1M	mg/l	40.9	0.4	0.9	Calculated value	0.09
	LN4	mg/kg	4.64	0.48	10.4	Median	0.35
	LO4	mg/kg				Median	
	TN3	µg/l	80.4	2.2	2.7	Robust mean	0.18
	TY3	µg/l	83.5	1.7	2.0	Median	0.13
	V2M	µg/l	7.35	0.37	5.0	Robust mean	0.25
B	LN4	mg/kg	10.3			Mean	
	LO4	mg/kg	10.4	0.7	7.1	Median	0.36
	TN3	mg/l	0.26	0.02	9.2	Robust mean	0.37
	TY3	mg/l	0.29	0.03	10.3	Median	0.41
	V2M	µg/l	88.8	6.5	7.3	Robust mean	0.37
Ba	LN4	mg/kg	161	13	8.1	Median	0.41
	LO4	mg/kg	161	7	4.5	Median	0.23
	TN3	µg/l	24.6	1.1	4.6	Median	0.31
	TY3	µg/l	25.1	0.6	2.2	Median	0.15
	V2M	µg/l	35.5	1.2	3.3	Robust mean	0.22
Ca	LN4	g/kg	37.0	1.7	4.6	Median	0.31
	LO4	g/kg	37.6	2.7	7.1	Median	0.36
	TN3	µg/l	66605	1599	2.4	Robust mean	0.24
	TY3	µg/l	67578	3311	4.9	Median	0.33
	V2M	µg/l	32905	658	2.0	Robust mean	0.20
Cd	A1M	mg/l	4.82	0.03	0.6	Calculated value	0.04
	LN4	mg/kg	0.67	0.09	13.3	Median	0.44
	LO4	mg/kg	0.68	0.10	14.9	Median	0.50
	TN3	µg/l	44.5	1.1	2.4	Robust mean	0.16
	TY3	µg/l	46.0	0.7	1.5	Median	0.10
	V2M	µg/l	5.09	0.15	3.0	Robust mean	0.20
Co	A1M	mg/l	24.4	0.1	0.5	Calculated value	0.05
	LN4	mg/kg	6.19	0.46	7.4	Median	0.30
	LO4	mg/kg	6.47	0.80	12.4	Median	0.50
	TN3	µg/l	57.7	3.3	5.7	Robust mean	0.29
	TY3	µg/l	60.2	2.8	4.6	Median	0.31
	V2M	µg/l	4.27	0.18	4.2	Robust mean	0.28
Cr	A1M	mg/l	39.0	0.2	0.5	Calculated value	0.05
	LN4	mg/kg	29.9	1.9	6.2	Median	0.31
	LO4	mg/kg	32.7	1.9	5.9	Median	0.30
	TN3	µg/l	107	5	4.6	Robust mean	0.31
	TY3	µg/l	105	3	2.8	Median	0.19
	V2M	µg/l	9.75	0.31	3.2	Robust mean	0.21

Measurand	Sample	Unit	Assigned value	U_{pt}	U_{pt}, %	Evaluation method of assigned value	u_{pt}/S_{pt}
Cu	A1M	mg/l	40.9	0.2	0.4	Calculated value	0.04
	LN4	mg/kg	385	17	4.5	Median	0.23
	LO4	mg/kg	392	8	2.0	Median	0.10
	TN3	µg/l	77.1	2.9	3.7	Robust mean	0.25
	TY3	µg/l	79.6	3.5	4.4	Median	0.29
	V2M	µg/l	9.86	0.52	5.3	Robust mean	0.27
Drw	L4M	%	93.8	1.1	1.1	Robust mean	0.22
Fe	A1M	mg/l	515	2	0.4	Calculated value	0.04
	LN4	g/kg	115	15	13.2	Median	0.66
	LO4	g/kg	118	4	3.0	Median	0.15
	TN3	µg/l	521	21	4.1	Robust mean	0.27
	TY3	µg/l	536	22	4.1	Median	0.27
	V2M	mg/l	0.79	0.03	4.2	Robust mean	0.28
Hg	A1Hg	µg/l	0.67	0.02	3.0	ID-ICP-MS	0.15
	LC4	mg/kg				Median	
	LN4	mg/kg	0.53			Median	
	LO4	mg/kg	0.52	0.01	2.8	Median	0.14
	T3Hg	µg/l	2.67	0.08	3.0	ID-ICP-MS	0.15
	V2Hg	µg/l	2.16	0.06	3.0	ID-ICP-MS	0.15
Mg	LN4	g/kg	3.99	0.24	5.9	Median	0.30
	LO4	g/kg	4.09	0.14	3.5	Median	0.23
	TN3	µg/l	21309	511	2.4	Robust mean	0.24
	TY3	µg/l	22200	1132	5.1	Median	0.34
	V2M	µg/l	8035	161	2.0	Robust mean	0.20
Mn	A1M	mg/l	297	1	0.4	Calculated value	0.04
	LN4	mg/kg	330	25	7.6	Median	0.30
	LO4	mg/kg	332	9	2.7	Mean	0.14
	TN3	µg/l	138	4	3.1	Robust mean	0.31
	TY3	µg/l	138	6	4.5	Median	0.30
	V2M	mg/l	0.20	0.01	3.3	Robust mean	0.22
Mo	LN4	mg/kg	5.94	0.83	14.0	Mean	0.56
	LO4	mg/kg	6.18	0.51	8.3	Mean	0.33
	TN3	mg/l	1.68	0.05	3.2	Robust mean	0.32
	TY3	mg/l	1.75	0.07	4.1	Median	0.27
	V2M	µg/l	26.9	0.9	3.2	Robust mean	0.21
Ni	A1M	mg/l	47.5	0.2	0.4	Calculated value	0.04
	LN4	mg/kg	21.6	1.2	5.6	Mean	0.28
	LO4	mg/kg	22.5	2.5	11.0	Median	0.44
	TN3	µg/l	106	6	5.3	Robust mean	0.35
	TY3	µg/l	109	5	4.5	Mean	0.30
	V2M	µg/l	9.64	0.27	2.8	Robust mean	0.19
N_{tot}	L4M	g/kg	28.2	1.2	4.1	Median	0.27
Pb	A1M	mg/l	45.5	0.2	0.5	Calculated value	0.05
	LN4	mg/kg	17.7	2.1	12.0	Median	0.48
	LO4	mg/kg	18.1	1.2	6.6	Median	0.26
	TN3	µg/l	90.6	2.7	3.0	ID-ICP-MS	0.20
	TY3	µg/l	88.2	3.0	3.4	Median	0.23
	V2M	µg/l	9.34	0.28	3.0	ID-ICP-MS	0.20

Measurand	Sample	Unit	Assigned value	U_{pt}	U_{pt}, %	Evaluation method of assigned value	u_{pt}/s_{pt}
P_{tot}	L4M	g/kg	36.2	1.2	3.2	Mean	0.21
Sb	LN4	mg/kg	9.56			Median	
	LO4	mg/kg	13.5	1.4	10.5	Median	0.35
	TN3	µg/l	85.5	3.6	4.2	Robust mean	0.28
	TY3	µg/l	88.3	3.6	4.1	Median	0.27
	V2M	µg/l	6.28	0.31	5.0	Robust mean	0.33
Se	A1M	mg/l	41.6	0.2	0.6	Calculated value	0.06
	LN4	mg/kg	12.8	1.2	9.2	Median	0.37
	LO4	mg/kg	12.3	1.5	12.0	Median	0.40
	TN3	µg/l	52.8	2.7	5.2	Robust mean	0.35
	TY3	µg/l	54.3	1.1	2.0	Median	0.13
	V2M	µg/l	6.41	0.28	4.4	Robust mean	0.29
Sn	LN4	mg/kg				Median	
	LO4	mg/kg	27.8	1.7	6.1	Median	0.31
	TN3	µg/l	18.5	1.1	6.2	Median	0.31
	TY3	µg/l	17.3			Median	
	V2M	µg/l	2.71	0.17	6.4	Median	0.32
Sr	LN4	mg/kg	97.3	5.4	5.6	Median	0.28
	LO4	mg/kg	98.0	5.9	6.0	Mean	0.30
	TN3	mg/l	0.22	0.01	5.6	Mean	0.37
	TY3	mg/l	0.22	0.01	4.7	Mean	0.31
	V2M	µg/l	91.7	2.8	3.1	Robust mean	0.31
S_{tot}	L4M	g/kg	11.1	0.5	4.7	Mean	0.31
	TN3	mg/l	168	4	2.1	Mean	0.21
	TY3	mg/l	170			Median	
	V2M	mg/l	31.7	0.6	1.8	Robust mean	0.18
V	A1M	mg/l	50.8	0.2	0.4	Calculated value	0.04
	LN4	mg/kg	28.2	1.6	5.7	Median	0.38
	LO4	mg/kg	30.0	2.3	7.8	Median	0.39
	TN3	µg/l	114	5	4.1	Mean	0.27
	TY3	µg/l	115	4	3.4	Median	0.23
	V2M	µg/l	8.48	0.47	5.5	Robust mean	0.28
Zn	A1M	mg/l	281	1	0.4	Calculated value	0.04
	LN4	mg/kg	593	22	3.7	Median	0.25
	LO4	mg/kg	595	21	3.5	Median	0.23
	TN3	µg/l	119	4	3.4	Robust mean	0.23
	TY3	µg/l	121	3	2.1	Median	0.14
	V2M	µg/l	52.0	1.9	3.6	Robust mean	0.24

U_{pt} = Expanded uncertainty of the assigned value
Criterion for reliability of the assigned value $u_{pt}/s_{pt} \leq 0.3$, where
s_{pt}= the standard deviation for proficiency assessment
u_{pt}= standard uncertainty of the assigned value

If $u_{pt}/s_{pt} \leq 0.3$, the assigned value is reliable and the z scores are qualified.

APPENDIX 6: Terms in the results tables

Results of each participant

Measurand	The tested parameter
Sample	The code of the sample
z score	Calculated as follows: $z = (x_i - x_{pt})/s_{pt}$, where x_i = the result of the individual participant x_{pt} = the assigned value s_{pt} = the standard deviation for proficiency assessment
Assigned value	The reference value
2×s_{pt} %	The standard deviation for proficiency assessment (s_{pt}) at the 95 % confidence level
Participant's result	The result reported by the participant (the mean value of the replicates)
Md	Median
sd	Standard deviation
sd%	Standard deviation, %
n (stat)	Number of results in statistical processing

Summary on the z scores

S – satisfactory ($-2 \leq z \leq 2$)
Q – questionable ($2 < z < 3$), positive error, the result deviates more than $2 \times s_{pt}$ from the assigned value
q – questionable ($-3 < z < -2$), negative error, the result deviates more than $2 \times s_{pt}$ from the assigned value
U – unsatisfactory ($z \geq 3$), positive error, the result deviates more than $3 \times s_{pt}$ from the assigned value
u – unsatisfactory ($z \leq -3$), negative error, the result deviates more than $3 \times s_{pt}$ from the assigned value

Robust analysis

The items of data are sorted into increasing order, $x_1, x_2, x_i, \ldots, x_p$.
Initial values for x^* and s^* are calculated as:
x^* = median of x_i (i = 1, 2, ...,p)
s^* = 1.483 × median of $|x_i - x^*|$ (i = 1, 2, ...,p)

The mean x^* and s^* are updated as follows:
Calculate $\varphi = 1.5 \times s^*$. A new value is then calculated for each result x_i ($i = 1, 2 \ldots p$):

$$x_i^* = \begin{cases} x^* - \varphi, & \text{if } x_i < x^* - \varphi \\ x^* + \varphi, & \text{if } x_i > x^* + \varphi, \\ x_i & \text{otherwise} \end{cases}$$

The new values of x^* and s^* are calculated from:

$$x^* = \sum x_i^* / p$$

$$s^* = 1.134\sqrt{\sum (x_i^* - x^*)^2 / (p-1)}$$

The robust estimates x^* and s^* can be derived by an iterative calculation, i.e. by updating the values of x^* and s^* several times, until the process convergences [2].

APPENDIX 7: Results of each participant

Participant 1												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-1.19	436	10	410	425	429	27	6.2	19
	g/kg	LO4		-3.13	6.99	20	4.80	6.99	7.06	0.65	9.2	6
	mg/l	TN3		-0.30	0.44	15	0.43	0.43	0.44	0.02	4.8	16
	µg/l	V2M		0.48	105	20	110	105	106	5	4.9	15
As	mg/kg	LO4					4.50	4.54	4.07	1.00	24.5	8
	µg/l	TN3		0.10	80.4	15	81.0	79.9	80.0	2.6	3.2	14
	µg/l	V2M		-0.07	7.35	20	7.30	7.38	7.35	0.48	6.6	14
B	mg/kg	LO4			10.4	20	*<10*	10.4	10.4	0.9	8.7	6
	mg/l	TN3		0.92	0.26	25	0.29	0.25	0.26	0.03	11.2	12
	µg/l	V2M		0.81	88.8	20	96.0	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LO4		-0.06	161	20	160	161	163	10	6.4	8
	µg/l	TN3		-0.87	24.6	15	23.0	24.6	24.3	1.8	7.3	10
	µg/l	V2M		-0.94	35.5	15	33.0	36.3	35.7	1.4	3.9	14
Ca	g/kg	LO4		0.90	37.6	20	41.0	37.6	38.2	3.8	10.1	8
	µg/l	TN3		-0.18	66605	10	66000	66600	66605	2050	3.1	13
	µg/l	V2M		-0.55	32905	10	32000	33065	32871	993	3.0	16
Cd	mg/l	A1M		0.22	4.82	15	4.90	4.76	4.83	0.26	5.3	18
	mg/kg	LO4		2.06	0.68	30	0.89	0.68	0.73	0.15	21.1	8
	µg/l	TN3		0.75	44.5	15	47.0	44.5	44.8	1.5	3.4	16
	µg/l	V2M		0.29	5.09	15	5.20	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		-1.15	24.4	10	23.0	24.0	24.0	1.0	4.0	16
	mg/kg	LO4		-2.81	6.47	25	4.20	6.47	6.21	1.09	17.5	8
	µg/l	TN3		0.05	57.7	20	58.0	57.6	57.7	4.5	7.9	15
	µg/l	V2M		0.41	4.27	15	4.40	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		-0.51	39.0	10	38.0	38.8	38.8	1.4	3.6	19
	mg/kg	LO4		-0.83	32.7	20	30.0	32.7	32.3	2.9	8.9	9
	µg/l	TN3		0.37	107	15	110	106	107	8	7.9	17
	µg/l	V2M		0.34	9.75	15	10.00	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		-1.42	40.9	10	38.0	40.5	40.4	1.9	4.8	17
	mg/kg	LO4		-0.05	392	20	390	392	392	11	2.9	9
	µg/l	TN3		-0.71	77.1	15	73.0	77.1	76.6	4.1	5.3	18
	µg/l	V2M		-0.26	9.86	20	9.60	9.85	9.95	0.56	5.7	17
Drw	%	L4M		0.00	93.8	5	93.8	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		-0.97	515	10	490	516	514	29	5.7	19
	g/kg	LO4		1.02	118	20	130	118	119	5	4.3	8
	µg/l	TN3		0.49	521	15	540	526	520	36	6.8	18
	mg/l	V2M		13488.78	0.79	15	800.00	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		1.19	0.67	20	0.75	0.67	0.66	0.06	8.7	12
	mg/kg	LO4		3.08	0.52	20	0.68	0.52	0.52	0.02	3.4	6
	µg/l	T3Hg		1.24	2.67	20	3.00	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		0.19	2.16	20	2.20	2.11	2.14	0.20	9.5	14
Mg	g/kg	LO4		-0.42	4.09	15	3.96	4.09	4.10	0.20	4.9	8
	µg/l	TN3		-0.20	21309	10	21100	21395	21253	803	3.8	14
	µg/l	V2M		-0.34	8035	10	7900	8020	8061	361	4.5	17

Participant 1												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Mn	mg/l	A1M		-0.47	297	10	290	301	301	14	4.7	20
	mg/kg	LO4		0.24	332	20	340	330	332	13	3.8	8
	µg/l	TN3		0.29	138	10	140	140	140	5	3.6	15
	mg/l	V2M		13986.67	0.20	15	210.00	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LO4		-1.79	6.18	25	4.80	6.25	6.18	0.77	12.5	9
	mg/l	TN3		0.24	1.68	10	1.70	1.68	1.68	0.07	4.4	13
	µg/l	V2M		2.03	26.9	15	31.0	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		-1.05	47.5	10	45.0	47.0	47.1	2.4	5.1	19
	mg/kg	LO4		2.31	22.5	25	29.0	22.5	22.3	3.6	16.2	9
	µg/l	TN3		-0.75	106	15	100	105	106	10	9.7	18
	µg/l	V2M		-0.47	9.64	15	9.30	9.67	9.61	0.51	5.3	14
N_{tot}	g/kg	L4M		0.52	28.2	15	29.3	28.2	27.6	1.8	6.5	10
Pb	mg/l	A1M		-1.54	45.5	10	42.0	44.8	45.3	2.5	5.5	18
	mg/kg	LO4		0.31	18.1	25	18.8	18.1	18.1	1.7	9.3	8
	µg/l	TN3		-2.00	90.6	15	77.0	83.9	85.3	7.6	8.9	14
	µg/l	V2M		-2.06	9.34	15	7.90	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		-0.44	36.2	15	35.0	35.7	36.2	1.8	5.1	10
Sb	mg/kg	LO4		-0.59	13.5	30	12.3	13.5	14.0	2.2	15.8	9
	µg/l	TN3		1.17	85.5	15	93.0	85.7	85.5	4.4	5.1	12
	µg/l	V2M		1.74	6.28	15	7.10	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		-0.29	41.6	10	41.0	41.7	41.6	2.2	5.2	15
	mg/kg	LO4		-1.25	12.3	30	10.0	12.3	11.7	2.0	16.8	8
	µg/l	TN3		0.30	52.8	15	54.0	52.4	52.6	3.9	7.5	12
	µg/l	V2M		-0.23	6.41	15	6.30	6.41	6.37	0.52	8.2	13
S_{tot}	g/kg	L4M		-1.32	11.1	15	10.0	11.0	11.1	0.9	7.8	11
	mg/l	TN3		0.24	168	10	170	170	168	5	3.1	9
	mg/l	V2M		-0.44	31.7	10	31.0	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		0.47	50.8	10	52.0	50.4	50.6	2.1	4.1	15
	mg/kg	LO4		-1.00	30.0	20	27.0	30.0	30.4	3.1	10.3	7
	µg/l	TN3		1.87	114	15	130	113	114	8	6.8	11
	µg/l	V2M		1.32	8.48	20	9.60	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		-0.78	281	10	270	279	282	18	6.4	19
	mg/kg	LO4		0.11	595	15	600	595	588	31	5.2	9
	µg/l	TN3		0.11	119	15	120	120	119	6	4.8	18
	µg/l	V2M		0.00	52.0	15	52.0	52.4	52.0	2.4	4.7	14

Participant 2												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		0.00	436	10	436	425	429	27	6.2	19
	g/kg	LN4		0.31	6.26	25	6.50	6.26	5.95	0.82	13.8	7
	mg/l	TN3		-0.30	0.44	15	0.43	0.43	0.44	0.02	4.8	16
	µg/l	V2M		-2.15	105	20	82	105	106	5	4.9	15
As	mg/l	A1M		-0.98	40.9	10	38.9	40.5	40.4	1.3	3.2	15
	mg/kg	LN4		-0.70	4.64	30	4.15	4.64	4.60	0.63	13.7	7
	µg/l	TN3		-0.32	80.4	15	78.5	79.9	80.0	2.6	3.2	14
	µg/l	V2M		-0.48	7.35	20	7.00	7.38	7.35	0.48	6.6	14
B	mg/kg	LN4			10.3		11.3	10.8	10.3	1.3	12.4	3
	mg/l	TN3		1.20	0.26	25	0.30	0.25	0.26	0.03	11.2	12

Participant 2												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
B	µg/l	V2M		-0.61	88.8	20	83.4	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LN4		-1.30	161	20	140	161	163	16	10.0	6
	µg/l	TN3		-2.11	24.6	15	20.7	24.6	24.3	1.8	7.3	10
	µg/l	V2M		-1.16	35.5	15	32.4	36.3	35.7	1.4	3.9	14
Ca	g/kg	LN4		0.65	37.0	15	38.8	37.0	37.5	2.1	5.6	6
	µg/l	TN3		-0.89	66605	10	63650	66600	66605	2050	3.1	13
	µg/l	V2M		0.08	32905	10	33030	33065	32871	993	3.0	16
Cd	mg/l	A1M		0.89	4.82	15	5.14	4.76	4.83	0.26	5.3	18
	mg/kg	LN4		-2.39	0.67	30	0.43	0.67	0.65	0.12	17.6	7
	µg/l	TN3		-0.15	44.5	15	44.0	44.5	44.8	1.5	3.4	16
	µg/l	V2M		-0.10	5.09	15	5.05	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		-0.08	24.4	10	24.3	24.0	24.0	1.0	4.0	16
	mg/kg	LN4		1.00	6.19	25	6.96	6.19	6.24	0.61	9.8	7
	µg/l	TN3		-0.23	57.7	20	56.4	57.6	57.7	4.5	7.9	15
	µg/l	V2M		-0.12	4.27	15	4.23	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		0.36	39.0	10	39.7	38.8	38.8	1.4	3.6	19
	mg/kg	LN4		0.23	29.9	20	30.6	29.9	29.8	2.6	8.8	8
	µg/l	TN3		-0.75	107	15	101	106	107	8	7.9	17
	µg/l	V2M		0.34	9.75	15	10.00	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		0.20	40.9	10	41.3	40.5	40.4	1.9	4.8	17
	mg/kg	LN4		-0.13	385	20	380	385	393	27	6.8	9
	µg/l	TN3		-0.33	77.1	15	75.2	77.1	76.6	4.1	5.3	18
	µg/l	V2M		-0.35	9.86	20	9.51	9.85	9.95	0.56	5.7	17
Drw	%	L4M		0.51	93.8	5	95.0	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		1.79	515	10	561	516	514	29	5.7	19
	g/kg	LN4		1.48	115	20	132	115	118	19	16.2	6
	µg/l	TN3		-0.92	521	15	485	526	520	36	6.8	18
	mg/l	V2M		-0.25	0.79	15	0.78	0.79	0.79	0.04	5.2	14
Hg	mg/kg	LN4			0.53		0.16	0.54	0.53	0.07	13.5	4
	µg/l	T3Hg		0.86	2.67	20	2.90	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		0.19	2.16	20	2.20	2.11	2.14	0.20	9.5	14
Mg	g/kg	LN4		-0.63	3.99	20	3.74	3.99	4.03	0.31	7.8	7
	µg/l	TN3		-0.47	21309	10	20810	21395	21253	803	3.8	14
	µg/l	V2M		-0.66	8035	10	7770	8020	8061	361	4.5	17
Mn	mg/l	A1M		0.00	297	10	297	301	301	14	4.7	20
	mg/kg	LN4		-1.50	330	25	268	330	330	36	10.8	8
	µg/l	TN3		-2.75	138	10	119	140	140	5	3.6	15
	mg/l	V2M		-1.13	0.20	15	0.18	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LN4		-1.95	5.94	25	4.49	6.34	5.94	1.15	19.3	8
	mg/l	TN3		-1.79	1.68	10	1.53	1.68	1.68	0.07	4.4	13
	µg/l	V2M		-0.74	26.9	15	25.4	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		0.13	47.5	10	47.8	47.0	47.1	2.4	5.1	19
	mg/kg	LN4		0.51	21.6	20	22.7	21.6	21.6	1.7	7.9	8
	µg/l	TN3		-0.25	106	15	104	105	106	10	9.7	18
	µg/l	V2M		-0.19	9.64	15	9.50	9.67	9.61	0.51	5.3	14
N_{tot}	g/kg	L4M		0.00	28.2	15	28.2	28.2	27.6	1.8	6.5	10
Pb	mg/l	A1M		0.13	45.5	10	45.8	44.8	45.3	2.5	5.5	18
	mg/kg	LN4		2.85	17.7	25	24.0	17.7	19.4	3.1	16.1	7

Participant 2												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Pb	µg/l	TN3		-1.53	90.6	15	80.2	83.9	85.3	7.6	8.9	14
	µg/l	V2M		-1.00	9.34	15	8.64	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		0.33	36.2	15	37.1	35.7	36.2	1.8	5.1	10
Sb	mg/kg	LN4			9.56		10.90	9.56	9.68	0.94	9.7	4
	µg/l	TN3		-0.64	85.5	15	81.4	85.7	85.5	4.4	5.1	12
	µg/l	V2M		-3.10	6.28	15	4.82	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		-0.77	41.6	10	40.0	41.7	41.6	2.2	5.2	15
	mg/kg	LN4		-0.44	12.8	25	12.1	12.8	12.2	1.5	12.2	7
	µg/l	TN3		-0.71	52.8	15	50.0	52.4	52.6	3.9	7.5	12
	µg/l	V2M		-2.79	6.41	15	5.07	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LN4					21.3	21.3	21.4	6.6	30.8	3
	µg/l	TN3		-1.46	18.5	20	15.8	18.5	18.1	1.5	8.2	7
	µg/l	V2M		-5.06	2.71	20	1.34	2.71	2.80	0.24	8.4	7
Sr	mg/kg	LN4		-0.96	97.3	20	88.0	97.3	98.3	6.7	6.8	6
	mg/l	TN3		-0.85	0.22	15	0.21	0.22	0.22	0.02	8.4	9
	µg/l	V2M		-0.20	91.7	10	90.8	92.2	91.7	3.4	3.7	12
S_{tot}	g/kg	L4M		-1.20	11.1	15	10.1	11.0	11.1	0.9	7.8	11
	mg/l	TN3		-0.36	168	10	165	170	168	5	3.1	9
	mg/l	V2M		0.00	31.7	10	31.7	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		0.71	50.8	10	52.6	50.4	50.6	2.1	4.1	15
	mg/kg	LN4		8.70	28.2	15	46.6	28.2	28.5	2.0	7.0	6
	µg/l	TN3		-1.05	114	15	105	113	114	8	6.8	11
	µg/l	V2M		-0.71	8.48	20	7.88	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		-0.14	281	10	279	279	282	18	6.4	19
	mg/kg	LN4		-1.15	593	15	542	593	599	33	5.6	9
	µg/l	TN3		-0.11	119	15	118	120	119	6	4.8	18
	µg/l	V2M		-0.36	52.0	15	50.6	52.4	52.0	2.4	4.7	14

Participant 3												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		1.01	436	10	458	425	429	27	6.2	19
	mg/l	TN3		-0.97	0.44	15	0.41	0.43	0.44	0.02	4.8	16
As	mg/l	A1M		-0.49	40.9	10	39.9	40.5	40.4	1.3	3.2	15
	µg/l	TN3		0.05	80.4	15	80.7	79.9	80.0	2.6	3.2	14
Cd	mg/l	A1M		0.86	4.82	15	5.13	4.76	4.83	0.26	5.3	18
	µg/l	TN3		0.27	44.5	15	45.4	44.5	44.8	1.5	3.4	16
Co	mg/l	A1M		0.49	24.4	10	25.0	24.0	24.0	1.0	4.0	16
	µg/l	TN3		-0.02	57.7	20	57.6	57.6	57.7	4.5	7.9	15
Cr	mg/l	A1M		0.10	39.0	10	39.2	38.8	38.8	1.4	3.6	19
	µg/l	TN3		-0.50	107	15	103	106	107	8	7.9	17
Cu	mg/l	A1M		0.73	40.9	10	42.4	40.5	40.4	1.9	4.8	17
	µg/l	TN3		0.80	77.1	15	81.7	77.1	76.6	4.1	5.3	18
Fe	mg/l	A1M		0.93	515	10	539	516	514	29	5.7	19
	µg/l	TN3		0.54	521	15	542	526	520	36	6.8	18
Hg	µg/l	A1Hg		-1.19	0.67	20	0.59	0.67	0.66	0.06	8.7	12
	µg/l	T3Hg		-0.60	2.67	20	2.51	2.58	2.60	0.29	11.1	17
Mn	mg/l	A1M		0.81	297	10	309	301	301	14	4.7	20
	µg/l	TN3		-0.58	138	10	134	140	140	5	3.6	15

Participant 3												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Mo	mg/l	TN3		-0.48	1.68	10	1.64	1.68	1.68	0.07	4.4	13
Ni	mg/l	A1M		1.52	47.5	10	51.1	47.0	47.1	2.4	5.1	19
	µg/l	TN3		1.01	106	15	114	105	106	10	9.7	18
Pb	mg/l	A1M		0.75	45.5	10	47.2	44.8	45.3	2.5	5.5	18
	µg/l	TN3		-1.06	90.6	15	83.4	83.9	85.3	7.6	8.9	14
Sb	µg/l	TN3		1.01	85.5	15	92.0	85.7	85.5	4.4	5.1	12
Se	mg/l	A1M		0.24	41.6	10	42.1	41.7	41.6	2.2	5.2	15
	µg/l	TN3		1.29	52.8	15	57.9	52.4	52.6	3.9	7.5	12
Zn	mg/l	A1M		1.35	281	10	300	279	282	18	6.4	19
	µg/l	TN3		0.45	119	15	123	120	119	6	4.8	18

Participant 4												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Ca	µg/l	TN3		-5.44	66605	10	48500	66600	66605	2050	3.1	13
Drw	%	L4M		0.02	93.8	5	93.8	93.8	93.7	1.9	2.0	15
Fe	µg/l	TN3		-1.10	521	15	478	526	520	36	6.8	18
Hg	mg/kg	LO4		-0.38	0.52	20	0.50	0.52	0.52	0.02	3.4	6
	µg/l	T3Hg		-1.50	2.67	20	2.27	2.58	2.60	0.29	11.1	17
Mg	µg/l	TN3		-3.92	21309	10	17130	21395	21253	803	3.8	14

Participant 5												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		1.33	436	10	465	425	429	27	6.2	19
	mg/l	TN3		10744.24	0.44	15	355.00	0.43	0.44	0.02	4.8	16
As	mg/l	A1M		-2.40	40.9	10	36.0	40.5	40.4	1.3	3.2	15
	µg/l	TN3		-0.40	80.4	15	78.0	79.9	80.0	2.6	3.2	14
Cd	mg/l	A1M		-0.89	4.82	15	4.50	4.76	4.83	0.26	5.3	18
	µg/l	TN3		-1.65	44.5	15	39.0	44.5	44.8	1.5	3.4	16
Co	mg/l	A1M		-0.33	24.4	10	24.0	24.0	24.0	1.0	4.0	16
	µg/l	TN3		-1.16	57.7	20	51.0	57.6	57.7	4.5	7.9	15
Cr	mg/l	A1M		0.51	39.0	10	40.0	38.8	38.8	1.4	3.6	19
	µg/l	TN3		-1.87	107	15	92	106	107	8	7.9	17
Cu	mg/l	A1M		2.00	40.9	10	45.0	40.5	40.4	1.9	4.8	17
	µg/l	TN3		-0.88	77.1	15	72.0	77.1	76.6	4.1	5.3	18
Fe	mg/l	A1M		-0.50	515	10	502	516	514	29	5.7	19
	µg/l	TN3		-1.64	521	15	457	526	520	36	6.8	18
Hg	µg/l	A1Hg		-1.79	0.67	20	0.55	0.67	0.66	0.06	8.7	12
	µg/l	T3Hg		-1.39	2.67	20	2.30	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		-0.74	2.16	20	2.00	2.11	2.14	0.20	9.5	14
Mn	mg/l	A1M		0.07	297	10	298	301	301	14	4.7	20
	µg/l	TN3		-2.61	138	10	120	140	140	5	3.6	15
Ni	mg/l	A1M		-0.21	47.5	10	47.0	47.0	47.1	2.4	5.1	19
	µg/l	TN3		-1.64	106	15	93	105	106	10	9.7	18
Pb	mg/l	A1M		-0.22	45.5	10	45.0	44.8	45.3	2.5	5.5	18
	µg/l	TN3		-2.30	90.6	15	75.0	83.9	85.3	7.6	8.9	14
V	mg/l	A1M		0.87	50.8	10	53.0	50.4	50.6	2.1	4.1	15
	µg/l	TN3		-0.94	114	15	106	113	114	8	6.8	11

Participant 5												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Zn	mg/l	A1M		-1.57	281	10	259	279	282	18	6.4	19
	µg/l	TN3		-1.46	119	15	106	120	119	6	4.8	18

Participant 6												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	TN3		0.70	0.44	15	0.46	0.43	0.44	0.02	4.8	16
As	µg/l	TN3		2.89	80.4	15	97.8	79.9	80.0	2.6	3.2	14
Ca	µg/l	TN3		0.57	66605	10	68500	66600	66605	2050	3.1	13
Cd	µg/l	TN3		0.15	44.5	15	45.0	44.5	44.8	1.5	3.4	16
Co	µg/l	TN3		0.65	57.7	20	61.5	57.6	57.7	4.5	7.9	15
Cr	µg/l	TN3		2.40	107	15	126	106	107	8	7.9	17
Cu	µg/l	TN3		-0.33	77.1	15	75.2	77.1	76.6	4.1	5.3	18
Fe	µg/l	TN3		0.15	521	15	527	526	520	36	6.8	18
Mg	µg/l	TN3		0.65	21309	10	22000	21395	21253	803	3.8	14
Mn	µg/l	TN3		1.04	138	10	145	140	140	5	3.6	15
Ni	µg/l	TN3		1.37	106	15	117	105	106	10	9.7	18
Pb	µg/l	TN3		0.19	90.6	15	91.9	83.9	85.3	7.6	8.9	14
Sb	µg/l	TN3		-0.03	85.5	15	85.3	85.7	85.5	4.4	5.1	12
Se	µg/l	TN3		-0.68	52.8	15	50.1	52.4	52.6	3.9	7.5	12
V	µg/l	TN3		0.54	114	15	119	113	114	8	6.8	11
Zn	µg/l	TN3		0.45	119	15	123	120	119	6	4.8	18

Participant 7												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	TY3		-0.93	0.44	20	0.40	0.44	0.46	0.04	9.2	9
Co	µg/l	TY3		-3.48	60.2	15	44.5	60.2	59.4	3.6	6.1	7
Cr	µg/l	TY3		-0.19	105	15	104	105	106	4	4.1	9
Fe	µg/l	TY3		0.00	536	15	536	536	535	33	6.2	9
Mg	µg/l	TY3		0.12	22200	15	22400	22200	21911	1366	6.2	6
Zn	µg/l	TY3		-3.75	121	15	87	121	122	3	2.8	7

Participant 8												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		0.76	436	10	453	425	429	27	6.2	19
	g/kg	LO4		-0.23	6.99	20	6.83	6.99	7.06	0.65	9.2	6
	mg/l	TN3		-0.76	0.44	15	0.42	0.43	0.44	0.02	4.8	16
	µg/l	V2M		-0.53	105	20	99	105	106	5	4.9	15
As	mg/l	A1M		-0.19	40.9	10	40.5	40.5	40.4	1.3	3.2	15
	mg/kg	LO4					4.58	4.54	4.07	1.00	24.5	8
	µg/l	TN3		-0.33	80.4	15	78.4	79.9	80.0	2.6	3.2	14
	µg/l	V2M		0.29	7.35	20	7.56	7.38	7.35	0.48	6.6	14
B	mg/kg	LO4		-1.08	10.4	20	9.3	10.4	10.4	0.9	8.7	6
	mg/l	TN3		-0.65	0.26	25	0.24	0.25	0.26	0.03	11.2	12
	µg/l	V2M		0.73	88.8	20	95.3	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LO4		0.81	161	20	174	161	163	10	6.4	8
	µg/l	TN3		0.43	24.6	15	25.4	24.6	24.3	1.8	7.3	10
	µg/l	V2M		0.70	35.5	15	37.4	36.3	35.7	1.4	3.9	14

Participant 8												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Ca	g/kg	LO4		-0.50	37.6	20	35.7	37.6	38.2	3.8	10.1	8
	µg/l	TN3		0.50	66605	10	68270	66600	66605	2050	3.1	13
	µg/l	V2M		-0.16	32905	10	32640	33065	32871	993	3.0	16
Cd	mg/l	A1M		-0.30	4.82	15	4.71	4.76	4.83	0.26	5.3	18
	mg/kg	LO4		1.81	0.68	30	0.87	0.68	0.73	0.15	21.1	8
	µg/l	TN3		-0.51	44.5	15	42.8	44.5	44.8	1.5	3.4	16
	µg/l	V2M		0.45	5.09	15	5.26	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		-0.58	24.4	10	23.7	24.0	24.0	1.0	4.0	16
	mg/kg	LO4		0.17	6.47	25	6.61	6.47	6.21	1.09	17.5	8
	µg/l	TN3		-0.50	57.7	20	54.8	57.6	57.7	4.5	7.9	15
	µg/l	V2M		0.66	4.27	15	4.48	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		-0.36	39.0	10	38.3	38.8	38.8	1.4	3.6	19
	mg/kg	LO4		0.40	32.7	20	34.0	32.7	32.3	2.9	8.9	9
	µg/l	TN3		-0.50	107	15	103	106	107	8	7.9	17
	µg/l	V2M		0.12	9.75	15	9.84	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		-0.19	40.9	10	40.5	40.5	40.4	1.9	4.8	17
	mg/kg	LO4		0.23	392	20	401	392	392	11	2.9	9
	µg/l	TN3		-0.16	77.1	15	76.2	77.1	76.6	4.1	5.3	18
	µg/l	V2M		0.35	9.86	20	10.21	9.85	9.95	0.56	5.7	17
Drw	%	L4M		-0.27	93.8	5	93.2	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		0.05	515	10	516	516	514	29	5.7	19
	g/kg	LO4		0.11	118	20	119	118	119	5	4.3	8
	µg/l	TN3		-0.20	521	15	513	526	520	36	6.8	18
	mg/l	V2M		0.10	0.79	15	0.80	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		0.25	0.67	20	0.69	0.67	0.66	0.06	8.7	12
	mg/kg	LO4		-0.17	0.52	20	0.51	0.52	0.52	0.02	3.4	6
	µg/l	T3Hg		0.15	2.67	20	2.71	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		0.42	2.16	20	2.25	2.11	2.14	0.20	9.5	14
Mg	g/kg	LO4		-0.13	4.09	15	4.05	4.09	4.10	0.20	4.9	8
	µg/l	TN3		0.91	21309	10	22280	21395	21253	803	3.8	14
	µg/l	V2M		0.54	8035	10	8252	8020	8061	361	4.5	17
Mn	mg/l	A1M		-0.39	297	10	291	301	301	14	4.7	20
	mg/kg	LO4		-0.30	332	20	322	330	332	13	3.8	8
	µg/l	TN3		-0.58	138	10	134	140	140	5	3.6	15
	mg/l	V2M		-0.31	0.20	15	0.20	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LO4		-0.27	6.18	25	5.97	6.25	6.18	0.77	12.5	9
	mg/l	TN3		0.02	1.68	10	1.68	1.68	1.68	0.07	4.4	13
	µg/l	V2M		0.46	26.9	15	27.8	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		-0.99	47.5	10	45.2	47.0	47.1	2.4	5.1	19
	mg/kg	LO4		-0.57	22.5	25	20.9	22.5	22.3	3.6	16.2	9
	µg/l	TN3		-0.50	106	15	102	105	106	10	9.7	18
	µg/l	V2M		0.21	9.64	15	9.79	9.67	9.61	0.51	5.3	14
Pb	mg/l	A1M		-0.31	45.5	10	44.8	44.8	45.3	2.5	5.5	18
	mg/kg	LO4		0.13	18.1	25	18.4	18.1	18.1	1.7	9.3	8
	µg/l	TN3		-0.07	90.6	15	90.1	83.9	85.3	7.6	8.9	14
	µg/l	V2M		-0.44	9.34	15	9.03	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		-0.18	36.2	15	35.7	35.7	36.2	1.8	5.1	10

Participant 8												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Sb	mg/kg	LO4		0.00	13.5	30	13.5	13.5	14.0	2.2	15.8	9
	µg/l	TN3		0.14	85.5	15	86.4	85.7	85.5	4.4	5.1	12
	µg/l	V2M		0.38	6.28	15	6.46	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		-0.48	41.6	10	40.6	41.7	41.6	2.2	5.2	15
	mg/kg	LO4		0.33	12.3	30	12.9	12.3	11.7	2.0	16.8	8
	µg/l	TN3		-0.08	52.8	15	52.5	52.4	52.6	3.9	7.5	12
	µg/l	V2M		0.04	6.41	15	6.43	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LO4		0.00	27.8	20	27.8	27.8	28.2	2.3	8.0	7
	µg/l	TN3		-1.08	18.5	20	16.5	18.5	18.1	1.5	8.2	7
	µg/l	V2M		1.07	2.71	20	3.00	2.71	2.80	0.24	8.4	7
Sr	mg/kg	LO4		0.41	98.0	20	102.0	98.0	98.0	7.8	7.9	7
	mg/l	TN3		0.61	0.22	15	0.23	0.22	0.22	0.02	8.4	9
	µg/l	V2M		0.64	91.7	10	94.6	92.2	91.7	3.4	3.7	12
S_{tot}	g/kg	L4M		0.38	11.1	15	11.4	11.0	11.1	0.9	7.8	11
	mg/l	TN3		0.49	168	10	172	170	168	5	3.1	9
	mg/l	V2M		0.17	31.7	10	32.0	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		-0.14	50.8	10	50.4	50.4	50.6	2.1	4.1	15
	mg/kg	LO4		-0.77	30.0	20	27.7	30.0	30.4	3.1	10.3	7
	µg/l	TN3		-0.12	114	15	113	113	114	8	6.8	11
	µg/l	V2M		0.34	8.48	20	8.77	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		-0.13	281	10	279	279	282	18	6.4	19
	mg/kg	LO4		-1.17	595	15	543	595	588	31	5.2	9
	µg/l	TN3		-0.78	119	15	112	120	119	6	4.8	18
	µg/l	V2M		0.26	52.0	15	53.0	52.4	52.0	2.4	4.7	14

Participant 9												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Hg	mg/kg	LC4					0.425	0.476	0.476	0.071	15.0	2

Participant 10												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	TN3		2.88	0.44	15	0.54	0.43	0.44	0.02	4.8	16
	mg/l	TY3		1.20	0.44	20	0.49	0.44	0.46	0.04	9.2	9
	µg/l	V2M		5.14	105	20	159	105	106	5	4.9	15
As	µg/l	TN3		0.70	80.4	15	84.6	79.9	80.0	2.6	3.2	14
	µg/l	V2M		-0.98	7.35	20	6.63	7.38	7.35	0.48	6.6	14
Ca	µg/l	TN3		3.93	66605	10	79700	66600	66605	2050	3.1	13
	µg/l	TY3		2.25	67578	15	79000	67578	67693	4024	5.9	6
	µg/l	V2M		0.48	32905	10	33700	33065	32871	993	3.0	16
Cd	mg/l	A1M		1.08	4.82	15	5.21	4.76	4.83	0.26	5.3	18
	mg/kg	LO4		-0.73	0.68	30	0.61	0.68	0.73	0.15	21.1	8
	µg/l	TN3		1.05	44.5	15	48.0	44.5	44.8	1.5	3.4	16
	µg/l	V2M		-1.36	5.09	15	4.57	5.08	5.08	0.25	4.9	16
Cr	mg/l	A1M		-0.82	39.0	10	37.4	38.8	38.8	1.4	3.6	19
	mg/kg	LO4		-1.83	32.7	20	26.7	32.7	32.3	2.9	8.9	9
	µg/l	TN3		0.75	107	15	113	106	107	8	7.9	17
	µg/l	TY3		0.13	105	15	106	105	106	4	4.1	9
	µg/l	V2M		0.29	9.75	15	9.96	9.85	9.72	0.43	4.4	16

Participant 10												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Cu	mg/kg	LO4		0.26	392	20	402	392	392	11	2.9	9
	µg/l	TN3		0.50	77.1	15	80.0	77.1	76.6	4.1	5.3	18
	µg/l	TY3		0.80	79.6	15	84.4	79.6	78.3	4.9	6.3	8
	µg/l	V2M		9.37	9.86	20	19.10	9.85	9.95	0.56	5.7	17
Drw	%	L4M		0.64	93.8	5	95.3	93.8	93.7	1.9	2.0	15
Fe	µg/l	TN3		-1.69	521	15	455	526	520	36	6.8	18
	µg/l	TY3		-1.62	536	15	471	536	535	33	6.2	9
	mg/l	V2M		-0.91	0.79	15	0.74	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		0.72	0.67	20	0.72	0.67	0.66	0.06	8.7	12
	mg/kg	LO4		0.08	0.52	20	0.52	0.52	0.52	0.02	3.4	6
	µg/l	T3Hg		1.54	2.67	20	3.08	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		1.30	2.16	20	2.44	2.11	2.14	0.20	9.5	14
Mg	µg/l	TN3		0.74	21309	10	22100	21395	21253	803	3.8	14
	µg/l	V2M		-0.19	8035	10	7960	8020	8061	361	4.5	17
Mn	µg/l	TN3		-4.35	138	10	108	140	140	5	3.6	15
	µg/l	TY3		-1.45	138	15	123	138	137	9	6.3	8
	mg/l	V2M		-2.73	0.20	15	0.16	0.20	0.20	0.01	4.9	14
Ni	mg/l	A1M		0.97	47.5	10	49.8	47.0	47.1	2.4	5.1	19
	mg/kg	LO4		-0.28	22.5	25	21.7	22.5	22.3	3.6	16.2	9
	µg/l	TN3		-1.60	106	15	93	105	106	10	9.7	18
	µg/l	V2M		1.19	9.64	15	10.50	9.67	9.61	0.51	5.3	14
N_{tot}	g/kg	L4M		-0.05	28.2	15	28.1	28.2	27.6	1.8	6.5	10
Pb	mg/l	A1M		1.41	45.5	10	48.7	44.8	45.3	2.5	5.5	18
	mg/kg	LO4		-0.31	18.1	25	17.4	18.1	18.1	1.7	9.3	8
	µg/l	TN3		2.12	90.6	15	105.0	83.9	85.3	7.6	8.9	14
	µg/l	TY3		0.83	88.2	15	93.7	88.2	87.7	4.2	4.8	8
	µg/l	V2M		-1.86	9.34	15	8.04	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		13.48	36.2	15	72.8	35.7	36.2	1.8	5.1	10
Zn	mg/kg	LO4		0.94	595	15	637	595	588	31	5.2	9
	µg/l	TN3		0.45	119	15	123	120	119	6	4.8	18
	µg/l	TY3		0.00	121	15	121	121	122	3	2.8	7
	µg/l	V2M		0.95	52.0	15	55.7	52.4	52.0	2.4	4.7	14

Participant 11												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-1.43	436	10	405	425	429	27	6.2	19
	g/kg	LN4		0.65	6.26	25	6.77	6.26	5.95	0.82	13.8	7
	mg/l	TN3		0.42	0.44	15	0.45	0.43	0.44	0.02	4.8	16
	µg/l	V2M		5.47	105	20	162	105	106	5	4.9	15
As	mg/l	A1M		-0.02	40.9	10	40.9	40.5	40.4	1.3	3.2	15
	mg/kg	LN4		0.24	4.64	30	4.81	4.64	4.60	0.63	13.7	7
	µg/l	TN3		-0.70	80.4	15	76.2	79.9	80.0	2.6	3.2	14
	µg/l	V2M		-1.10	7.35	20	6.54	7.38	7.35	0.48	6.6	14
B	mg/kg	LN4			10.3		10.8	10.8	10.3	1.3	12.4	3
	mg/l	TN3		-1.20	0.26	25	0.22	0.25	0.26	0.03	11.2	12
	µg/l	V2M		-2.06	88.8	20	70.5	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LN4		0.76	161	20	173	161	163	16	10.0	6
	µg/l	TN3		0.31	24.6	15	25.2	24.6	24.3	1.8	7.3	10

Participant 11												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Ba	µg/l	V2M		0.54	35.5	15	36.9	36.3	35.7	1.4	3.9	14
Ca	g/kg	LN4		-11.88	37.0	15	4.0	37.0	37.5	2.1	5.6	6
	µg/l	TN3		-18.09	66605	10	6346	66600	66605	2050	3.1	13
	µg/l	V2M		-18.03	32905	10	3245	33065	32871	993	3.0	16
Cd	mg/l	A1M		-0.55	4.82	15	4.62	4.76	4.83	0.26	5.3	18
	mg/kg	LN4		0.00	0.67	30	0.67	0.67	0.65	0.12	17.6	7
	µg/l	TN3		-0.03	44.5	15	44.4	44.5	44.8	1.5	3.4	16
	µg/l	V2M		1.26	5.09	15	5.57	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		-1.07	24.4	10	23.1	24.0	24.0	1.0	4.0	16
	mg/kg	LN4		0.00	6.19	25	6.19	6.19	6.24	0.61	9.8	7
	µg/l	TN3		-0.18	57.7	20	56.7	57.6	57.7	4.5	7.9	15
	µg/l	V2M		-2.75	4.27	15	3.39	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		-1.38	39.0	10	36.3	38.8	38.8	1.4	3.6	19
	mg/kg	LN4		0.80	29.9	20	32.3	29.9	29.8	2.6	8.8	8
	µg/l	TN3		-1.48	107	15	95	106	107	8	7.9	17
	µg/l	V2M		-3.66	9.75	15	7.07	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		-1.34	40.9	10	38.2	40.5	40.4	1.9	4.8	17
	mg/kg	LN4		0.00	385	20	385	385	393	27	6.8	9
	µg/l	TN3		-0.84	77.1	15	72.2	77.1	76.6	4.1	5.3	18
	µg/l	V2M		-3.31	9.86	20	6.60	9.85	9.95	0.56	5.7	17
Fe	mg/l	A1M		-1.38	515	10	480	516	514	29	5.7	19
	g/kg	LN4		-0.20	115	20	113	115	118	19	16.2	6
	µg/l	TN3		16.77	521	15	1176	526	520	36	6.8	18
	mg/l	V2M		8.14	0.79	15	1.27	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		45.04	0.67	20	3.69	0.67	0.66	0.06	8.7	12
	mg/kg	LC4					0.526	0.476	0.476	0.071	15.0	2
	mg/kg	LN4			0.53		0.44	0.54	0.53	0.07	13.5	4
	µg/l	T3Hg		8.67	2.67	20	4.98	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		8.15	2.16	20	3.92	2.11	2.14	0.20	9.5	14
Mg	g/kg	LN4		1.21	3.99	20	4.47	3.99	4.03	0.31	7.8	7
	µg/l	TN3		-1.82	21309	10	19367	21395	21253	803	3.8	14
	µg/l	V2M		-1.71	8035	10	7350	8020	8061	361	4.5	17
Mn	mg/l	A1M		-1.82	297	10	270	301	301	14	4.7	20
	mg/kg	LN4		0.07	330	25	333	330	330	36	10.8	8
	µg/l	TN3		0.62	138	10	142	140	140	5	3.6	15
	mg/l	V2M		-0.87	0.20	15	0.19	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LN4		1.13	5.94	25	6.78	6.34	5.94	1.15	19.3	8
	mg/l	TN3		-0.39	1.68	10	1.65	1.68	1.68	0.07	4.4	13
	µg/l	V2M		-0.49	26.9	15	25.9	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		-1.79	47.5	10	43.3	47.0	47.1	2.4	5.1	19
	mg/kg	LN4		0.09	21.6	20	21.8	21.6	21.6	1.7	7.9	8
	µg/l	TN3		-2.33	106	15	88	105	106	10	9.7	18
	µg/l	V2M		-13.33	9.64	15	0.00	9.67	9.61	0.51	5.3	14
Pb	mg/l	A1M		-1.39	45.5	10	42.3	44.8	45.3	2.5	5.5	18
	mg/kg	LN4		-0.30	17.7	25	17.0	17.7	19.4	3.1	16.1	7
	µg/l	TN3		-0.28	90.6	15	88.7	83.9	85.3	7.6	8.9	14
	µg/l	V2M		2.43	9.34	15	11.04	8.58	8.64	0.44	5.1	13

Participant 11												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Sb	mg/kg	LN4			9.56		8.70	9.56	9.68	0.94	9.7	4
	µg/l	TN3		-0.62	85.5	15	81.6	85.7	85.5	4.4	5.1	12
	µg/l	V2M		-1.10	6.28	15	5.76	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		-0.79	41.6	10	40.0	41.7	41.6	2.2	5.2	15
	mg/kg	LN4		-0.03	12.8	25	12.8	12.8	12.2	1.5	12.2	7
	µg/l	TN3		-0.55	52.8	15	50.6	52.4	52.6	3.9	7.5	12
	µg/l	V2M		1.68	6.41	15	7.22	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LN4					28.1	21.3	21.4	6.6	30.8	3
	µg/l	TN3		0.55	18.5	20	19.5	18.5	18.1	1.5	8.2	7
	µg/l	V2M		1.92	2.71	20	3.23	2.71	2.80	0.24	8.4	7
Sr	mg/kg	LN4		0.00	97.3	20	97.3	97.3	98.3	6.7	6.8	6
	mg/l	TN3		-1.27	0.22	15	0.20	0.22	0.22	0.02	8.4	9
	µg/l	V2M		-1.03	91.7	10	87.0	92.2	91.7	3.4	3.7	12
V	mg/l	A1M		-1.55	50.8	10	46.9	50.4	50.6	2.1	4.1	15
	mg/kg	LN4		0.52	28.2	15	29.3	28.2	28.5	2.0	7.0	6
	µg/l	TN3		-0.90	114	15	106	113	114	8	6.8	11
	µg/l	V2M		1.63	8.48	20	9.86	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		-0.83	281	10	269	279	282	18	6.4	19
	mg/kg	LN4		0.60	593	15	620	593	599	33	5.6	9
	µg/l	TN3		2.78	119	15	144	120	119	6	4.8	18
	µg/l	V2M		5.70	52.0	15	74.2	52.4	52.0	2.4	4.7	14

Participant 12												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		0.37	436	10	444	425	429	27	6.2	19
	g/kg	LO4		85.42	6.99	20	66.70	6.99	7.06	0.65	9.2	6
	mg/l	TY3		1.64	0.44	20	0.51	0.44	0.46	0.04	9.2	9
	µg/l	V2M		2.10	105	20	127	105	106	5	4.9	15
As	mg/l	A1M		0.00	40.9	10	40.9	40.5	40.4	1.3	3.2	15
	mg/kg	LO4					2.57	4.54	4.07	1.00	24.5	8
	µg/l	TY3		-0.61	83.5	15	79.7	83.5	82.5	2.2	2.7	7
	µg/l	V2M			7.35	20	*<10*	7.38	7.35	0.48	6.6	14
B	mg/kg	LO4		0.96	10.4	20	11.4	10.4	10.4	0.9	8.7	6
	mg/l	TY3		-1.66	0.29	25	0.23	0.29	0.28	0.04	13.7	7
	µg/l	V2M		-0.21	88.8	20	86.9	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LO4		-0.25	161	20	157	161	163	10	6.4	8
	µg/l	TY3		-0.53	25.1	15	24.1	25.1	25.1	0.7	3.0	7
	µg/l	V2M		0.34	35.5	15	36.4	36.3	35.7	1.4	3.9	14
Ca	g/kg	LO4		1.01	37.6	20	41.4	37.6	38.2	3.8	10.1	8
	µg/l	TY3		-0.11	67578	15	67000	67578	67693	4024	5.9	6
	µg/l	V2M		0.12	32905	10	33100	33065	32871	993	3.0	16
Cd	mg/l	A1M		0.64	4.82	15	5.05	4.76	4.83	0.26	5.3	18
	mg/kg	LO4		-0.79	0.68	30	0.60	0.68	0.73	0.15	21.1	8
	µg/l	TY3		0.26	46.0	15	46.9	46.0	45.9	0.8	1.8	6
	µg/l	V2M		0.84	5.09	15	5.41	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		0.57	24.4	10	25.1	24.0	24.0	1.0	4.0	16
	mg/kg	LO4		1.63	6.47	25	7.79	6.47	6.21	1.09	17.5	8
	µg/l	TY3		-0.18	60.2	15	59.4	60.2	59.4	3.6	6.1	7

Participant 12												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Co	µg/l	V2M		-0.37	4.27	15	4.15	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		-0.10	39.0	10	38.8	38.8	38.8	1.4	3.6	19
	mg/kg	LO4		-0.06	32.7	20	32.5	32.7	32.3	2.9	8.9	9
	µg/l	TY3		0.00	105	15	105	105	106	4	4.1	9
	µg/l	V2M		-0.12	9.75	15	9.66	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		-0.10	40.9	10	40.7	40.5	40.4	1.9	4.8	17
	mg/kg	LO4		-0.18	392	20	385	392	392	11	2.9	9
	µg/l	TY3		-0.23	79.6	15	78.2	79.6	78.3	4.9	6.3	8
	µg/l	V2M		0.65	9.86	20	10.50	9.85	9.95	0.56	5.7	17
Drw	%	L4M		0.22	93.8	5	94.3	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		-0.50	515	10	502	516	514	29	5.7	19
	g/kg	LO4		-0.08	118	20	117	118	119	5	4.3	8
	µg/l	TY3		-0.60	536	15	512	536	535	33	6.2	9
	mg/l	V2M		-0.27	0.79	15	0.77	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		-5.19	0.67	20	0.32	0.67	0.66	0.06	8.7	12
	mg/kg	LO4		0.15	0.52	20	0.53	0.52	0.52	0.02	3.4	6
	µg/l	T3Hg		-1.31	2.67	20	2.32	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		-1.90	2.16	20	1.75	2.11	2.14	0.20	9.5	14
Mg	g/kg	LO4		1.08	4.09	15	4.42	4.09	4.10	0.20	4.9	8
	µg/l	TY3		-1.26	22200	15	20100	22200	21911	1366	6.2	6
	µg/l	V2M		-0.29	8035	10	7920	8020	8061	361	4.5	17
Mn	mg/l	A1M		1.21	297	10	315	301	301	14	4.7	20
	mg/kg	LO4		0.00	332	20	332	330	332	13	3.8	8
	µg/l	TY3		0.10	138	15	139	138	137	9	6.3	8
	mg/l	V2M		0.33	0.20	15	0.21	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LO4		-0.93	6.18	25	5.46	6.25	6.18	0.77	12.5	9
	mg/l	TY3		-0.61	1.75	15	1.67	1.75	1.76	0.10	5.5	7
	µg/l	V2M		-0.59	26.9	15	25.7	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		-0.04	47.5	10	47.4	47.0	47.1	2.4	5.1	19
	mg/kg	LO4		0.00	22.5	25	22.5	22.5	22.3	3.6	16.2	9
	µg/l	TY3		-0.12	109	15	108	109	109	6	5.9	7
	µg/l	V2M		-0.61	9.64	15	9.20	9.67	9.61	0.51	5.3	14
Pb	mg/l	A1M		0.31	45.5	10	46.2	44.8	45.3	2.5	5.5	18
	mg/kg	LO4		-0.71	18.1	25	16.5	18.1	18.1	1.7	9.3	8
	µg/l	TY3		-0.18	88.2	15	87.0	88.2	87.7	4.2	4.8	8
	µg/l	V2M			9.34	15	*<10*	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		3.62	36.2	15	46.0	35.7	36.2	1.8	5.1	10
Sb	mg/kg	LO4		2.57	13.5	30	18.7	13.5	14.0	2.2	15.8	9
	µg/l	TY3		-0.69	88.3	15	83.7	88.3	86.7	4.7	5.4	7
	µg/l	V2M			6.28	15	*<10*	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		1.15	41.6	10	44.0	41.7	41.6	2.2	5.2	15
	mg/kg	LO4		0.76	12.3	30	13.7	12.3	11.7	2.0	16.8	8
	µg/l	TY3		0.07	54.3	15	54.6	54.3	54.3	1.3	2.5	6
	µg/l	V2M			6.41	15	*<10*	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LO4		0.54	27.8	20	29.3	27.8	28.2	2.3	8.0	7
	µg/l	TY3			17.3		17.2	17.3	17.5	1.3	7.4	4
	µg/l	V2M			2.71	20	*<10*	2.71	2.80	0.24	8.4	7

Participant 12												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Sr	mg/kg	LO4		0.51	98.0	20	103.0	98.0	98.0	7.8	7.9	7
	mg/l	TY3		0.12	0.22	15	0.22	0.22	0.22	0.01	5.8	6
	µg/l	V2M		0.13	91.7	10	92.3	92.2	91.7	3.4	3.7	12
S_{tot}	g/kg	L4M		-0.12	11.1	15	11.0	11.0	11.1	0.9	7.8	11
	mg/l	TY3			170		170	170	168	19	11.5	5
	mg/l	V2M		0.06	31.7	10	31.8	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		-0.31	50.8	10	50.0	50.4	50.6	2.1	4.1	15
	mg/kg	LO4		0.60	30.0	20	31.8	30.0	30.4	3.1	10.3	7
	µg/l	TY3		-0.81	115	15	108	115	115	5	4.5	7
	µg/l	V2M			8.48	20	*<10*	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		1.78	281	10	306	279	282	18	6.4	19
	mg/kg	LO4		-0.87	595	15	556	595	588	31	5.2	9
	µg/l	TY3		0.33	121	15	124	121	122	3	2.8	7
	µg/l	V2M		0.18	52.0	15	52.7	52.4	52.0	2.4	4.7	14

Participant 13												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-0.69	436	10	421	425	429	27	6.2	19
	mg/l	TN3		-0.67	0.44	15	0.42	0.43	0.44	0.02	4.8	16
	mg/l	TY3		-0.32	0.44	20	0.43	0.44	0.46	0.04	9.2	9
	µg/l	V2M		-0.29	105	20	102	105	106	5	4.9	15
As	mg/l	A1M		-0.24	40.9	10	40.4	40.5	40.4	1.3	3.2	15
	mg/kg	LN4		0.35	4.64	30	4.89	4.64	4.60	0.63	13.7	7
	µg/l	TN3		-0.05	80.4	15	80.1	79.9	80.0	2.6	3.2	14
	µg/l	TY3		-0.65	83.5	15	79.4	83.5	82.5	2.2	2.7	7
	µg/l	V2M		0.11	7.35	20	7.43	7.38	7.35	0.48	6.6	14
B	mg/l	TN3		-0.40	0.26	25	0.25	0.25	0.26	0.03	11.2	12
	mg/l	TY3		-1.38	0.29	25	0.24	0.29	0.28	0.04	13.7	7
	µg/l	V2M		0.56	88.8	20	93.8	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LN4		-0.37	161	20	155	161	163	16	10.0	6
	µg/l	TN3		-1.03	24.6	15	22.7	24.6	24.3	1.8	7.3	10
	µg/l	TY3		0.11	25.1	15	25.3	25.1	25.1	0.7	3.0	7
	µg/l	V2M		-0.83	35.5	15	33.3	36.3	35.7	1.4	3.9	14
Cd	mg/l	A1M		-0.91	4.82	15	4.49	4.76	4.83	0.26	5.3	18
	mg/kg	LN4		0.20	0.67	30	0.69	0.67	0.65	0.12	17.6	7
	µg/l	TN3		-0.30	44.5	15	43.5	44.5	44.8	1.5	3.4	16
	µg/l	TY3		0.09	46.0	15	46.3	46.0	45.9	0.8	1.8	6
	µg/l	V2M		-0.55	5.09	15	4.88	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		-0.57	24.4	10	23.7	24.0	24.0	1.0	4.0	16
	mg/kg	LN4		-0.19	6.19	25	6.04	6.19	6.24	0.61	9.8	7
	µg/l	TN3		-0.07	57.7	20	57.3	57.6	57.7	4.5	7.9	15
	µg/l	TY3		-0.38	60.2	15	58.5	60.2	59.4	3.6	6.1	7
	µg/l	V2M		-0.19	4.27	15	4.21	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		0.15	39.0	10	39.3	38.8	38.8	1.4	3.6	19
	mg/kg	LN4		-0.23	29.9	20	29.2	29.9	29.8	2.6	8.8	8
	µg/l	TN3		-0.12	107	15	106	106	107	8	7.9	17
	µg/l	TY3		0.00	105	15	105	105	106	4	4.1	9
	µg/l	V2M		-0.25	9.75	15	9.57	9.85	9.72	0.43	4.4	16

Participant 13												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Cu	mg/l	A1M		-0.20	40.9	10	40.5	40.5	40.4	1.9	4.8	17
	mg/kg	LN4		-0.13	385	20	380	385	393	27	6.8	9
	µg/l	TN3		-0.80	77.1	15	72.5	77.1	76.6	4.1	5.3	18
	µg/l	TY3		-1.01	79.6	15	73.6	79.6	78.3	4.9	6.3	8
	µg/l	V2M		0.12	9.86	20	9.98	9.85	9.95	0.56	5.7	17
Drw	%	L4M		1.49	93.8	5	97.3	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		0.16	515	10	519	516	514	29	5.7	19
	µg/l	TN3		0.90	521	15	556	526	520	36	6.8	18
	µg/l	TY3		0.42	536	15	553	536	535	33	6.2	9
	mg/l	V2M		0.22	0.79	15	0.80	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		-0.03	0.67	20	0.67	0.67	0.66	0.06	8.7	12
	mg/kg	LN4			0.53		0.52	0.54	0.53	0.07	13.5	4
	µg/l	T3Hg		0.00	2.67	20	2.67	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		-0.46	2.16	20	2.06	2.11	2.14	0.20	9.5	14
Mn	mg/l	A1M		0.40	297	10	303	301	301	14	4.7	20
	mg/kg	LN4		-0.17	330	25	323	330	330	36	10.8	8
	µg/l	TN3		-0.58	138	10	134	140	140	5	3.6	15
	µg/l	TY3		-0.58	138	15	132	138	137	9	6.3	8
	mg/l	V2M		-0.27	0.20	15	0.20	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LN4		0.75	5.94	25	6.50	6.34	5.94	1.15	19.3	8
	mg/l	TN3		0.36	1.68	10	1.71	1.68	1.68	0.07	4.4	13
	mg/l	TY3		-0.46	1.75	15	1.69	1.75	1.76	0.10	5.5	7
	µg/l	V2M		0.10	26.9	15	27.1	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		-0.13	47.5	10	47.2	47.0	47.1	2.4	5.1	19
	mg/kg	LN4		-0.14	21.6	20	21.3	21.6	21.6	1.7	7.9	8
	µg/l	TN3		-0.38	106	15	103	105	106	10	9.7	18
	µg/l	TY3		-0.49	109	15	105	109	109	6	5.9	7
	µg/l	V2M		-0.15	9.64	15	9.53	9.67	9.61	0.51	5.3	14
N_{tot}	g/kg	L4M		-1.18	28.2	15	25.7	28.2	27.6	1.8	6.5	10
Pb	mg/l	A1M		-1.41	45.5	10	42.3	44.8	45.3	2.5	5.5	18
	mg/kg	LN4		-0.09	17.7	25	17.5	17.7	19.4	3.1	16.1	7
	µg/l	TN3		-1.69	90.6	15	79.1	83.9	85.3	7.6	8.9	14
	µg/l	TY3		-0.65	88.2	15	83.9	88.2	87.7	4.2	4.8	8
	µg/l	V2M		-1.08	9.34	15	8.58	8.58	8.64	0.44	5.1	13
Sb	µg/l	TN3		0.19	85.5	15	86.7	85.7	85.5	4.4	5.1	12
	µg/l	TY3		0.27	88.3	15	90.1	88.3	86.7	4.7	5.4	7
	µg/l	V2M		0.23	6.28	15	6.39	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		0.67	41.6	10	43.0	41.7	41.6	2.2	5.2	15
	mg/kg	LN4		0.38	12.8	25	13.4	12.8	12.2	1.5	12.2	7
	µg/l	TN3		-0.15	52.8	15	52.2	52.4	52.6	3.9	7.5	12
	µg/l	TY3		0.12	54.3	15	54.8	54.3	54.3	1.3	2.5	6
	µg/l	V2M		-0.44	6.41	15	6.20	6.41	6.37	0.52	8.2	13
V	mg/l	A1M		-0.51	50.8	10	49.5	50.4	50.6	2.1	4.1	15
	mg/kg	LN4		-0.09	28.2	15	28.0	28.2	28.5	2.0	7.0	6
	µg/l	TN3		0.23	114	15	116	113	114	8	6.8	11
	µg/l	TY3		-0.12	115	15	114	115	115	5	4.5	7
	µg/l	V2M		-0.28	8.48	20	8.24	8.39	8.52	0.67	7.8	13

Participant 13												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Zn	mg/l	A1M		0.43	281	10	287	279	282	18	6.4	19
	mg/kg	LN4		-0.02	593	15	592	593	599	33	5.6	9
	µg/l	TN3		-0.67	119	15	113	120	119	6	4.8	18
	µg/l	TY3		-0.33	121	15	118	121	122	3	2.8	7
	µg/l	V2M		-0.72	52.0	15	49.2	52.4	52.0	2.4	4.7	14

Participant 14												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-1.51	436	10	403	425	429	27	6.2	19
	g/kg	LN4		-0.92	6.26	25	5.54	6.26	5.95	0.82	13.8	7
	mg/l	TN3		6.12	0.44	15	0.64	0.43	0.44	0.02	4.8	16
	µg/l	V2M		47.90	105	20	608	105	106	5	4.9	15
B	mg/l	TN3		-1.11	0.26	25	0.22	0.25	0.26	0.03	11.2	12
	µg/l	V2M		-0.43	88.8	20	85.0	90.6	88.2	10.2	11.5	15
Ca	g/kg	LN4		-0.61	37.0	15	35.3	37.0	37.5	2.1	5.6	6
	µg/l	TN3		0.00	66605	10	66600	66600	66605	2050	3.1	13
	µg/l	V2M		0.91	32905	10	34400	33065	32871	993	3.0	16
Cu	mg/l	A1M		-1.27	40.9	10	38.3	40.5	40.4	1.9	4.8	17
	mg/kg	LN4		0.75	385	20	414	385	393	27	6.8	9
	µg/l	TN3		4.13	77.1	15	101.0	77.1	76.6	4.1	5.3	18
	µg/l	V2M		59.17	9.86	20	68.20	9.85	9.95	0.56	5.7	17
Drw	%	L4M		0.77	93.8	5	95.6	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		-1.09	515	10	487	516	514	29	5.7	19
	g/kg	LN4		-2.30	115	20	89	115	118	19	16.2	6
	µg/l	TN3		8.04	521	15	835	526	520	36	6.8	18
	mg/l	V2M		14.01	0.79	15	1.62	0.79	0.79	0.04	5.2	14
Mg	g/kg	LN4		0.35	3.99	20	4.13	3.99	4.03	0.31	7.8	7
	µg/l	TN3		0.09	21309	10	21400	21395	21253	803	3.8	14
	µg/l	V2M		0.36	8035	10	8180	8020	8061	361	4.5	17
Mn	mg/l	A1M		1.62	297	10	321	301	301	14	4.7	20
	mg/kg	LN4		0.53	330	25	352	330	330	36	10.8	8
	µg/l	TN3		17.25	138	10	257	140	140	5	3.6	15
	mg/l	V2M		17.87	0.20	15	0.47	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LN4		-2.13	5.94	25	4.36	6.34	5.94	1.15	19.3	8
	mg/l	TN3		-0.83	1.68	10	1.61	1.68	1.68	0.07	4.4	13
	µg/l	V2M		-0.30	26.9	15	26.3	26.9	27.0	1.6	6.0	15
N_{tot}	g/kg	L4M		0.47	28.2	15	29.2	28.2	27.6	1.8	6.5	10
P_{tot}	g/kg	L4M		-4.68	36.2	15	23.5	35.7	36.2	1.8	5.1	10
S_{tot}	g/kg	L4M		-3.00	11.1	15	8.6	11.0	11.1	0.9	7.8	11
	mg/l	TN3		0.24	168	10	170	170	168	5	3.1	9
	mg/l	V2M		0.00	31.7	10	31.7	31.8	31.6	1.2	3.9	13
Zn	mg/l	A1M		2.92	281	10	322	279	282	18	6.4	19
	mg/kg	LN4		0.79	593	15	628	593	599	33	5.6	9
	µg/l	TN3		10.98	119	15	217	120	119	6	4.8	18
	µg/l	V2M		130.77	52.0	15	562.0	52.4	52.0	2.4	4.7	14

Participant 15												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-0.83	436	10	418	425	429	27	6.2	19
	g/kg	LO4		1.67	6.99	20	8.16	6.99	7.06	0.65	9.2	6
	mg/l	TN3		-1.15	0.44	15	0.40	0.43	0.44	0.02	4.8	16
	mg/l	TY3		0.02	0.44	20	0.44	0.44	0.46	0.04	9.2	9
	µg/l	V2M		-0.03	105	20	105	105	106	5	4.9	15
As	mg/l	A1M		-0.71	40.9	10	39.4	40.5	40.4	1.3	3.2	15
	mg/kg	LO4					2.67	4.54	4.07	1.00	24.5	8
	µg/l	TN3		-0.08	80.4	15	79.9	79.9	80.0	2.6	3.2	14
	µg/l	TY3		-0.24	83.5	15	82.0	83.5	82.5	2.2	2.7	7
	µg/l	V2M		1.02	7.35	20	8.10	7.38	7.35	0.48	6.6	14
B	mg/kg	LO4		0.10	10.4	20	10.5	10.4	10.4	0.9	8.7	6
	mg/l	TN3		0.98	0.26	25	0.29	0.25	0.26	0.03	11.2	12
	mg/l	TY3		0.61	0.29	25	0.31	0.29	0.28	0.04	13.7	7
	µg/l	V2M		-1.30	88.8	20	77.3	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LO4		-0.70	161	20	150	161	163	10	6.4	8
	µg/l	TN3		-0.11	24.6	15	24.4	24.6	24.3	1.8	7.3	10
	µg/l	TY3		-0.48	25.1	15	24.2	25.1	25.1	0.7	3.0	7
	µg/l	V2M		-0.45	35.5	15	34.3	36.3	35.7	1.4	3.9	14
Ca	g/kg	LO4		1.76	37.6	20	44.2	37.6	38.2	3.8	10.1	8
	µg/l	TN3		-0.98	66605	10	63350	66600	66605	2050	3.1	13
	µg/l	TY3		-0.81	67578	15	63490	67578	67693	4024	5.9	6
	µg/l	V2M		-0.73	32905	10	31700	33065	32871	993	3.0	16
Cd	mg/l	A1M		0.36	4.82	15	4.95	4.76	4.83	0.26	5.3	18
	mg/kg	LO4			0.68	30	*<0,3*	0.68	0.73	0.15	21.1	8
	µg/l	TN3		-0.72	44.5	15	42.1	44.5	44.8	1.5	3.4	16
	µg/l	TY3		-1.54	46.0	15	40.7	46.0	45.9	0.8	1.8	6
	µg/l	V2M		-0.47	5.09	15	4.91	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		-1.48	24.4	10	22.6	24.0	24.0	1.0	4.0	16
	mg/kg	LO4		-0.12	6.47	25	6.37	6.47	6.21	1.09	17.5	8
	µg/l	TN3		-1.04	57.7	20	51.7	57.6	57.7	4.5	7.9	15
	µg/l	TY3		-1.82	60.2	15	52.0	60.2	59.4	3.6	6.1	7
	µg/l	V2M		-1.22	4.27	15	3.88	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		-0.26	39.0	10	38.5	38.8	38.8	1.4	3.6	19
	mg/kg	LO4		-0.52	32.7	20	31.0	32.7	32.3	2.9	8.9	9
	µg/l	TN3		-0.76	107	15	101	106	107	8	7.9	17
	µg/l	TY3		-0.52	105	15	101	105	106	4	4.1	9
	µg/l	V2M		-0.93	9.75	15	9.07	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		-0.68	40.9	10	39.5	40.5	40.4	1.9	4.8	17
	mg/kg	LO4		-0.28	392	20	381	392	392	11	2.9	9
	µg/l	TN3		-1.42	77.1	15	68.9	77.1	76.6	4.1	5.3	18
	µg/l	TY3		-1.79	79.6	15	68.9	79.6	78.3	4.9	6.3	8
	µg/l	V2M		-0.52	9.86	20	9.35	9.85	9.95	0.56	5.7	17
Drw	%	L4M		-1.73	93.8	5	89.8	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		-1.19	515	10	484	516	514	29	5.7	19
	g/kg	LO4		1.69	118	20	138	118	119	5	4.3	8
	µg/l	TN3		-0.77	521	15	491	526	520	36	6.8	18
	µg/l	TY3		-0.32	536	15	523	536	535	33	6.2	9
	mg/l	V2M		-1.30	0.79	15	0.71	0.79	0.79	0.04	5.2	14

Participant 15												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Hg	µg/l	A1Hg		0.00	0.67	20	0.67	0.67	0.66	0.06	8.7	12
	mg/kg	LO4		7.31	0.52	20	0.90	0.52	0.52	0.02	3.4	6
	µg/l	T3Hg		-0.79	2.67	20	2.46	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		-0.88	2.16	20	1.97	2.11	2.14	0.20	9.5	14
Mg	g/kg	LO4		0.26	4.09	15	4.17	4.09	4.10	0.20	4.9	8
	µg/l	TN3		-0.96	21309	10	20290	21395	21253	803	3.8	14
	µg/l	TY3		-1.02	22200	15	20510	22200	21911	1366	6.2	6
	µg/l	V2M		-0.78	8035	10	7720	8020	8061	361	4.5	17
Mn	mg/l	A1M		0.44	297	10	304	301	301	14	4.7	20
	mg/kg	LO4		0.37	332	20	344	330	332	13	3.8	8
	µg/l	TN3		0.49	138	10	141	140	140	5	3.6	15
	µg/l	TY3		-0.67	138	15	131	138	137	9	6.3	8
	mg/l	V2M		0.07	0.20	15	0.20	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LO4		0.09	6.18	25	6.25	6.25	6.18	0.77	12.5	9
	mg/l	TN3		1.07	1.68	10	1.77	1.68	1.68	0.07	4.4	13
	mg/l	TY3		1.14	1.75	15	1.90	1.75	1.76	0.10	5.5	7
	µg/l	V2M		-0.05	26.9	15	26.8	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		-0.57	47.5	10	46.2	47.0	47.1	2.4	5.1	19
	mg/kg	LO4		-2.54	22.5	25	15.4	22.5	22.3	3.6	16.2	9
	µg/l	TN3		-0.38	106	15	103	105	106	10	9.7	18
	µg/l	TY3		-1.17	109	15	99	109	109	6	5.9	7
	µg/l	V2M		-0.50	9.64	15	9.28	9.67	9.61	0.51	5.3	14
N_{tot}	g/kg	L4M		-1.38	28.2	15	25.3	28.2	27.6	1.8	6.5	10
Pb	mg/l	A1M		-0.62	45.5	10	44.1	44.8	45.3	2.5	5.5	18
	mg/kg	LO4		-0.13	18.1	25	17.8	18.1	18.1	1.7	9.3	8
	µg/l	TN3		-1.32	90.6	15	81.6	83.9	85.3	7.6	8.9	14
	µg/l	TY3		-0.80	88.2	15	82.9	88.2	87.7	4.2	4.8	8
	µg/l	V2M		-1.30	9.34	15	8.43	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		-11.70	36.2	15	4.4	35.7	36.2	1.8	5.1	10
Sb	mg/kg	LO4		-3.70	13.5	30	6.0	13.5	14.0	2.2	15.8	9
	µg/l	TN3		-0.31	85.5	15	83.5	85.7	85.5	4.4	5.1	12
	µg/l	TY3		-1.63	88.3	15	77.5	88.3	86.7	4.7	5.4	7
	µg/l	V2M		-0.08	6.28	15	6.24	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		0.58	41.6	10	42.8	41.7	41.6	2.2	5.2	15
	mg/kg	LO4		-2.22	12.3	30	8.2	12.3	11.7	2.0	16.8	8
	µg/l	TN3		-2.12	52.8	15	44.4	52.4	52.6	3.9	7.5	12
	µg/l	TY3		-1.77	54.3	15	47.1	54.3	54.3	1.3	2.5	6
	µg/l	V2M		-0.15	6.41	15	6.34	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LO4		0.29	27.8	20	28.6	27.8	28.2	2.3	8.0	7
	µg/l	TN3			18.5	20	*<50*	18.5	18.1	1.5	8.2	7
	µg/l	TY3			17.3		*<50*	17.3	17.5	1.3	7.4	4
	µg/l	V2M			2.71	20	*<50*	2.71	2.80	0.24	8.4	7
Sr	mg/kg	LO4		0.00	98.0	20	98.0	98.0	98.0	7.8	7.9	7
	mg/l	TN3		0.06	0.22	15	0.22	0.22	0.22	0.02	8.4	9
	mg/l	TY3		-0.30	0.22	15	0.22	0.22	0.22	0.01	5.8	6
	µg/l	V2M		0.35	91.7	10	93.3	92.2	91.7	3.4	3.7	12

Participant 15												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
S_{tot}	g/kg	L4M		1.12	11.1	15	12.0	11.0	11.1	0.9	7.8	11
	mg/l	TN3		-0.20	168	10	166	170	168	5	3.1	9
	mg/l	TY3			170		142	170	168	19	11.5	5
	mg/l	V2M		1.45	31.7	10	34.0	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		-0.08	50.8	10	50.6	50.4	50.6	2.1	4.1	15
	mg/kg	LO4		-4.70	30.0	20	15.9	30.0	30.4	3.1	10.3	7
	µg/l	TN3		-0.54	114	15	109	113	114	8	6.8	11
	µg/l	TY3		-0.65	115	15	109	115	115	5	4.5	7
	µg/l	V2M		-0.70	8.48	20	7.89	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		-1.50	281	10	260	279	282	18	6.4	19
	mg/kg	LO4		-0.63	595	15	567	595	588	31	5.2	9
	µg/l	TN3		-3.25	119	15	90	120	119	6	4.8	18
	µg/l	TY3		-2.87	121	15	95	121	122	3	2.8	7
	µg/l	V2M		-1.00	52.0	15	48.1	52.4	52.0	2.4	4.7	14

Participant 16												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-1.34	436	10	407	425	429	27	6.2	19
	g/kg	LO4		-1.19	6.99	20	6.16	6.99	7.06	0.65	9.2	6
	mg/l	TN3		-0.18	0.44	15	0.43	0.43	0.44	0.02	4.8	16
	µg/l	V2M		-0.24	105	20	103	105	106	5	4.9	15
As	mg/l	A1M		-1.08	40.9	10	38.7	40.5	40.4	1.3	3.2	15
	mg/kg	LO4					5.04	4.54	4.07	1.00	24.5	8
	µg/l	TN3		-0.36	80.4	15	78.2	79.9	80.0	2.6	3.2	14
	µg/l	V2M		-0.64	7.35	20	6.88	7.38	7.35	0.48	6.6	14
B	mg/kg	LO4		0.87	10.4	20	11.3	10.4	10.4	0.9	8.7	6
	mg/l	TN3		-0.68	0.26	25	0.24	0.25	0.26	0.03	11.2	12
	µg/l	V2M		-0.19	88.8	20	87.1	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LO4		0.67	161	20	172	161	163	10	6.4	8
	µg/l	TN3		1.36	24.6	15	27.1	24.6	24.3	1.8	7.3	10
	µg/l	V2M		0.34	35.5	15	36.4	36.3	35.7	1.4	3.9	14
Ca	g/kg	LO4		-0.59	37.6	20	35.4	37.6	38.2	3.8	10.1	8
	µg/l	TN3		-0.34	66605	10	65480	66600	66605	2050	3.1	13
	µg/l	V2M		-0.51	32905	10	32070	33065	32871	993	3.0	16
Cd	mg/l	A1M		-0.58	4.82	15	4.61	4.76	4.83	0.26	5.3	18
	mg/kg	LO4		0.06	0.68	30	0.69	0.68	0.73	0.15	21.1	8
	µg/l	TN3		-0.09	44.5	15	44.2	44.5	44.8	1.5	3.4	16
	µg/l	V2M		-0.58	5.09	15	4.87	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		0.70	24.4	10	25.3	24.0	24.0	1.0	4.0	16
	mg/kg	LO4		0.11	6.47	25	6.56	6.47	6.21	1.09	17.5	8
	µg/l	TN3		0.90	57.7	20	62.9	57.6	57.7	4.5	7.9	15
	µg/l	V2M		0.59	4.27	15	4.46	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		0.13	39.0	10	39.3	38.8	38.8	1.4	3.6	19
	mg/kg	LO4		0.31	32.7	20	33.7	32.7	32.3	2.9	8.9	9
	µg/l	TN3		0.40	107	15	110	106	107	8	7.9	17
	µg/l	V2M		0.33	9.75	15	9.99	9.85	9.72	0.43	4.4	16

Participant 16												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Cu	mg/l	A1M		0.01	40.9	10	40.9	40.5	40.4	1.9	4.8	17
	mg/kg	LO4		0.23	392	20	401	392	392	11	2.9	9
	µg/l	TN3		0.40	77.1	15	79.4	77.1	76.6	4.1	5.3	18
	µg/l	V2M		0.32	9.86	20	10.18	9.85	9.95	0.56	5.7	17
Drw	%	L4M		-0.30	93.8	5	93.1	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		-0.10	515	10	512	516	514	29	5.7	19
	g/kg	LO4		-0.11	118	20	117	118	119	5	4.3	8
	µg/l	TN3		0.33	521	15	534	526	520	36	6.8	18
	mg/l	V2M		13237.30	0.79	15	785.10	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		0.60	0.67	20	0.71	0.67	0.66	0.06	8.7	12
	mg/kg	LO4		0.58	0.52	20	0.55	0.52	0.52	0.02	3.4	6
	µg/l	T3Hg		-0.30	2.67	20	2.59	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		1.81	2.16	20	2.55	2.11	2.14	0.20	9.5	14
Mg	g/kg	LO4		0.13	4.09	15	4.13	4.09	4.10	0.20	4.9	8
	µg/l	TN3		0.08	21309	10	21390	21395	21253	803	3.8	14
	µg/l	V2M		-0.04	8035	10	8020	8020	8061	361	4.5	17
Mn	mg/l	A1M		-0.09	297	10	296	301	301	14	4.7	20
	mg/kg	LO4		-0.14	332	20	327	330	332	13	3.8	8
	µg/l	TN3		0.29	138	10	140	140	140	5	3.6	15
	mg/l	V2M		-0.10	0.20	15	0.20	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LO4		0.75	6.18	25	6.76	6.25	6.18	0.77	12.5	9
	mg/l	TN3		-0.12	1.68	10	1.67	1.68	1.68	0.07	4.4	13
	µg/l	V2M		-0.30	26.9	15	26.3	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		0.51	47.5	10	48.7	47.0	47.1	2.4	5.1	19
	mg/kg	LO4		0.36	22.5	25	23.5	22.5	22.3	3.6	16.2	9
	µg/l	TN3		0.84	106	15	113	105	106	10	9.7	18
	µg/l	V2M		0.39	9.64	15	9.92	9.67	9.61	0.51	5.3	14
N_{tot}	g/kg	L4M		0.33	28.2	15	28.9	28.2	27.6	1.8	6.5	10
Pb	mg/l	A1M		-1.07	45.5	10	43.1	44.8	45.3	2.5	5.5	18
	mg/kg	LO4		0.62	18.1	25	19.5	18.1	18.1	1.7	9.3	8
	µg/l	TN3		-0.75	90.6	15	85.5	83.9	85.3	7.6	8.9	14
	µg/l	V2M		-0.19	9.34	15	9.21	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		-0.88	36.2	15	33.8	35.7	36.2	1.8	5.1	10
Sb	mg/kg	LO4		0.64	13.5	30	14.8	13.5	14.0	2.2	15.8	9
	µg/l	TN3		-1.03	85.5	15	78.9	85.7	85.5	4.4	5.1	12
	µg/l	V2M		-0.23	6.28	15	6.17	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		0.27	41.6	10	42.2	41.7	41.6	2.2	5.2	15
	mg/kg	LO4		0.43	12.3	30	13.1	12.3	11.7	2.0	16.8	8
	µg/l	TN3		0.38	52.8	15	54.3	52.4	52.6	3.9	7.5	12
	µg/l	V2M		0.00	6.41	15	6.41	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LO4		-0.07	27.8	20	27.6	27.8	28.2	2.3	8.0	7
	µg/l	TN3		-0.43	18.5	20	17.7	18.5	18.1	1.5	8.2	7
	µg/l	V2M		0.00	2.71	20	2.71	2.71	2.80	0.24	8.4	7
Sr	mg/kg	LO4		-0.39	98.0	20	94.2	98.0	98.0	7.8	7.9	7
	mg/l	TN3		-0.18	0.22	15	0.22	0.22	0.22	0.02	8.4	9
	µg/l	V2M		-1.09	91.7	10	86.7	92.2	91.7	3.4	3.7	12

Participant 16												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
S_{tot}	g/kg	L4M		-0.60	11.1	15	10.6	11.0	11.1	0.9	7.8	11
	mg/l	TN3		0.33	168	10	171	170	168	5	3.1	9
	mg/l	V2M		0.26	31.7	10	32.1	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		-0.05	50.8	10	50.7	50.4	50.6	2.1	4.1	15
	mg/kg	LO4		0.00	30.0	20	30.0	30.0	30.4	3.1	10.3	7
	µg/l	TN3		0.35	114	15	117	113	114	8	6.8	11
	µg/l	V2M		-0.34	8.48	20	8.19	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		-0.60	281	10	273	279	282	18	6.4	19
	mg/kg	LO4		-0.01	595	15	595	595	588	31	5.2	9
	µg/l	TN3		0.32	119	15	122	120	119	6	4.8	18
	µg/l	V2M		0.03	52.0	15	52.1	52.4	52.0	2.4	4.7	14

Participant 17												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-0.60	436	10	423	425	429	27	6.2	19
	g/kg	LO4		0.04	6.99	20	7.02	6.99	7.06	0.65	9.2	6
	mg/l	TY3		-0.02	0.44	20	0.44	0.44	0.46	0.04	9.2	9
	µg/l	V2M		-0.19	105	20	103	105	106	5	4.9	15
As	mg/l	A1M		-1.08	40.9	10	38.7	40.5	40.4	1.3	3.2	15
	mg/kg	LO4					4.59	4.54	4.07	1.00	24.5	8
	µg/l	TY3		0.21	83.5	15	84.8	83.5	82.5	2.2	2.7	7
	µg/l	V2M		0.10	7.35	20	7.42	7.38	7.35	0.48	6.6	14
B	mg/kg	LO4		-0.95	10.4	20	9.4	10.4	10.4	0.9	8.7	6
	mg/l	TY3		-1.24	0.29	25	0.25	0.29	0.28	0.04	13.7	7
	µg/l	V2M		0.33	88.8	20	91.7	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LO4		0.00	161	20	161	161	163	10	6.4	8
	µg/l	TY3		0.00	25.1	15	25.1	25.1	25.1	0.7	3.0	7
	µg/l	V2M		0.11	35.5	15	35.8	36.3	35.7	1.4	3.9	14
Ca	g/kg	LO4		-0.98	37.6	20	33.9	37.6	38.2	3.8	10.1	8
	µg/l	TY3		-0.82	67578	15	63400	67578	67693	4024	5.9	6
	µg/l	V2M		0.60	32905	10	33900	33065	32871	993	3.0	16
Cd	mg/l	A1M		1.38	4.82	15	5.32	4.76	4.83	0.26	5.3	18
	mg/kg	LO4		2.67	0.68	30	0.95	0.68	0.73	0.15	21.1	8
	µg/l	TY3		-0.09	46.0	15	45.7	46.0	45.9	0.8	1.8	6
	µg/l	V2M		-0.37	5.09	15	4.95	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		2.70	24.4	10	27.7	24.0	24.0	1.0	4.0	16
	mg/kg	LO4		-1.00	6.47	25	5.66	6.47	6.21	1.09	17.5	8
	µg/l	TY3		0.16	60.2	15	60.9	60.2	59.4	3.6	6.1	7
	µg/l	V2M		0.06	4.27	15	4.29	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		1.38	39.0	10	41.7	38.8	38.8	1.4	3.6	19
	mg/kg	LO4		0.00	32.7	20	32.7	32.7	32.3	2.9	8.9	9
	µg/l	TY3		1.14	105	15	114	105	106	4	4.1	9
	µg/l	V2M		4.85	9.75	15	13.30	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		-5.48	40.9	10	29.7	40.5	40.4	1.9	4.8	17
	mg/kg	LO4		0.00	392	20	392	392	392	11	2.9	9
	µg/l	TY3		-0.08	79.6	15	79.1	79.6	78.3	4.9	6.3	8
	µg/l	V2M		-0.30	9.86	20	9.56	9.85	9.95	0.56	5.7	17
Drw	%	L4M		0.11	93.8	5	94.1	93.8	93.7	1.9	2.0	15

Participant 17												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Fe	mg/l	A1M		0.04	515	10	516	516	514	29	5.7	19
	g/kg	LO4		0.17	118	20	120	118	119	5	4.3	8
	µg/l	TY3		-0.30	536	15	524	536	535	33	6.2	9
	mg/l	V2M		-1.00	0.79	15	0.73	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		3.75	0.67	20	0.92	0.67	0.66	0.06	8.7	12
	mg/kg	LO4		-0.19	0.52	20	0.51	0.52	0.52	0.02	3.4	6
	µg/l	T3Hg		-0.04	2.67	20	2.66	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		3.70	2.16	20	2.96	2.11	2.14	0.20	9.5	14
Mg	g/kg	LO4		-0.29	4.09	15	4.00	4.09	4.10	0.20	4.9	8
	µg/l	TY3		-0.12	22200	15	22000	22200	21911	1366	6.2	6
	µg/l	V2M		-0.36	8035	10	7890	8020	8061	361	4.5	17
Mn	mg/l	A1M		0.74	297	10	308	301	301	14	4.7	20
	mg/kg	LO4		-0.27	332	20	323	330	332	13	3.8	8
	µg/l	TY3		-0.19	138	15	136	138	137	9	6.3	8
	mg/l	V2M		-0.53	0.20	15	0.19	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LO4		0.63	6.18	25	6.67	6.25	6.18	0.77	12.5	9
	mg/l	TY3		0.99	1.75	15	1.88	1.75	1.76	0.10	5.5	7
	µg/l	V2M		0.20	26.9	15	27.3	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		1.35	47.5	10	50.7	47.0	47.1	2.4	5.1	19
	mg/kg	LO4		0.11	22.5	25	22.8	22.5	22.3	3.6	16.2	9
	µg/l	TY3		0.00	109	15	109	109	109	6	5.9	7
	µg/l	V2M		0.22	9.64	15	9.80	9.67	9.61	0.51	5.3	14
N_{tot}	g/kg	L4M		-1.65	28.2	15	24.7	28.2	27.6	1.8	6.5	10
Pb	mg/l	A1M		1.01	45.5	10	47.8	44.8	45.3	2.5	5.5	18
	mg/kg	LO4		4.64	18.1	25	28.6	18.1	18.1	1.7	9.3	8
	µg/l	TY3		0.48	88.2	15	91.4	88.2	87.7	4.2	4.8	8
	µg/l	V2M		-0.44	9.34	15	9.03	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		1.18	36.2	15	39.4	35.7	36.2	1.8	5.1	10
Sb	mg/kg	LO4		0.20	13.5	30	13.9	13.5	14.0	2.2	15.8	9
	µg/l	TY3		-0.12	88.3	15	87.5	88.3	86.7	4.7	5.4	7
	µg/l	V2M		0.23	6.28	15	6.39	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		2.36	41.6	10	46.5	41.7	41.6	2.2	5.2	15
	mg/kg	LO4		-0.38	12.3	30	11.6	12.3	11.7	2.0	16.8	8
	µg/l	TY3		-0.10	54.3	15	53.9	54.3	54.3	1.3	2.5	6
	µg/l	V2M		0.00	6.41	15	6.41	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LO4		4.46	27.8	20	40.2	27.8	28.2	2.3	8.0	7
	µg/l	TY3			17.3		16.2	17.3	17.5	1.3	7.4	4
	µg/l	V2M		-4.13	2.71	20	1.59	2.71	2.80	0.24	8.4	7
Sr	mg/kg	LO4		-0.02	98.0	20	97.8	98.0	98.0	7.8	7.9	7
	mg/l	TY3		-0.91	0.22	15	0.21	0.22	0.22	0.01	5.8	6
	µg/l	V2M		-1.18	91.7	10	86.3	92.2	91.7	3.4	3.7	12
S_{tot}	g/kg	L4M		1.08	11.1	15	12.0	11.0	11.1	0.9	7.8	11
	mg/l	TY3			170		158	170	168	19	11.5	5
	mg/l	V2M		-1.14	31.7	10	29.9	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		1.61	50.8	10	54.9	50.4	50.6	2.1	4.1	15
	mg/kg	LO4		1.30	30.0	20	33.9	30.0	30.4	3.1	10.3	7
	µg/l	TY3		0.00	115	15	115	115	115	5	4.5	7
	µg/l	V2M		-0.01	8.48	20	8.47	8.39	8.52	0.67	7.8	13

Participant 17												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Zn	mg/l	A1M		1.85	281	10	307	279	282	18	6.4	19
	mg/kg	LO4		0.47	595	15	616	595	588	31	5.2	9
	µg/l	TY3		6.83	121	15	183	121	122	3	2.8	7
	µg/l	V2M		0.85	52.0	15	55.3	52.4	52.0	2.4	4.7	14

Participant 18												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-17.85	436	10	47	425	429	27	6.2	19
	g/kg	LN4		-0.84	6.26	25	5.60	6.26	5.95	0.82	13.8	7
	mg/l	TN3		0.27	0.44	15	0.45	0.43	0.44	0.02	4.8	16
	µg/l	V2M		-0.70	105	20	98	105	106	5	4.9	15
As	mg/l	A1M		-0.54	40.9	10	39.8	40.5	40.4	1.3	3.2	15
	mg/kg	LN4		-1.44	4.64	30	3.64	4.64	4.60	0.63	13.7	7
	µg/l	TN3		0.80	80.4	15	85.2	79.9	80.0	2.6	3.2	14
	µg/l	V2M		0.31	7.35	20	7.58	7.38	7.35	0.48	6.6	14
B	mg/l	TN3		0.15	0.26	25	0.27	0.25	0.26	0.03	11.2	12
	µg/l	V2M		1.26	88.8	20	100.0	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LN4		-0.12	161	20	159	161	163	16	10.0	6
	µg/l	TN3		-0.11	24.6	15	24.4	24.6	24.3	1.8	7.3	10
	µg/l	V2M		0.30	35.5	15	36.3	36.3	35.7	1.4	3.9	14
Ca	g/kg	LN4		0.29	37.0	15	37.8	37.0	37.5	2.1	5.6	6
	µg/l	TN3		0.57	66605	10	68500	66600	66605	2050	3.1	13
	µg/l	V2M		0.18	32905	10	33200	33065	32871	993	3.0	16
Cd	mg/l	A1M		-0.39	4.82	15	4.68	4.76	4.83	0.26	5.3	18
	mg/kg	LN4		0.46	0.67	30	0.72	0.67	0.65	0.12	17.6	7
	µg/l	TN3		0.36	44.5	15	45.7	44.5	44.8	1.5	3.4	16
	µg/l	V2M		0.18	5.09	15	5.16	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		-0.41	24.4	10	23.9	24.0	24.0	1.0	4.0	16
	mg/kg	LN4		0.56	6.19	25	6.62	6.19	6.24	0.61	9.8	7
	µg/l	TN3		0.83	57.7	20	62.5	57.6	57.7	4.5	7.9	15
	µg/l	V2M		0.66	4.27	15	4.48	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		-0.56	39.0	10	37.9	38.8	38.8	1.4	3.6	19
	mg/kg	LN4		0.87	29.9	20	32.5	29.9	29.8	2.6	8.8	8
	µg/l	TN3		0.62	107	15	112	106	107	8	7.9	17
	µg/l	V2M		0.48	9.75	15	10.10	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		-0.68	40.9	10	39.5	40.5	40.4	1.9	4.8	17
	mg/kg	LN4		0.00	385	20	385	385	393	27	6.8	9
	µg/l	TN3		0.69	77.1	15	81.1	77.1	76.6	4.1	5.3	18
	µg/l	V2M		0.45	9.86	20	10.30	9.85	9.95	0.56	5.7	17
Drw	%	L4M		-1.32	93.8	5	90.7	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		0.89	515	10	538	516	514	29	5.7	19
	g/kg	LN4		-9.59	115	20	5	115	118	19	16.2	6
	g/kg	LO4		-0.42	118	20	113	118	119	5	4.3	8
	µg/l	TN3		0.54	521	15	542	526	520	36	6.8	18
	mg/l	V2M		0.51	0.79	15	0.82	0.79	0.79	0.04	5.2	14

Participant 18												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Hg	µg/l	A1Hg		-0.06	0.67	20	0.67	0.67	0.66	0.06	8.7	12
	µg/l	T3Hg		-0.34	2.67	20	2.58	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		-0.14	2.16	20	2.13	2.11	2.14	0.20	9.5	14
Mg	g/kg	LN4		0.00	3.99	20	3.99	3.99	4.03	0.31	7.8	7
	µg/l	TN3		0.46	21309	10	21800	21395	21253	803	3.8	14
	µg/l	V2M		0.49	8035	10	8230	8020	8061	361	4.5	17
Mn	mg/l	A1M		1.28	297	10	316	301	301	14	4.7	20
	mg/kg	LN4		0.34	330	25	344	330	330	36	10.8	8
	µg/l	TN3		0.72	138	10	143	140	140	5	3.6	15
	mg/l	V2M		0.67	0.20	15	0.21	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LN4		-1.20	5.94	25	5.05	6.34	5.94	1.15	19.3	8
	mg/kg	LO4		1.64	6.18	25	7.45	6.25	6.18	0.77	12.5	9
	mg/l	TN3		1.19	1.68	10	1.78	1.68	1.68	0.07	4.4	13
	µg/l	V2M		0.64	26.9	15	28.2	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		-0.42	47.5	10	46.5	47.0	47.1	2.4	5.1	19
	mg/kg	LN4		0.93	21.6	20	23.6	21.6	21.6	1.7	7.9	8
	µg/l	TN3		1.01	106	15	114	105	106	10	9.7	18
	µg/l	V2M		0.37	9.64	15	9.91	9.67	9.61	0.51	5.3	14
Pb	mg/l	A1M		-0.31	45.5	10	44.8	44.8	45.3	2.5	5.5	18
	mg/kg	LN4		2.17	17.7	25	22.5	17.7	19.4	3.1	16.1	7
	µg/l	TN3		-0.19	90.6	15	89.3	83.9	85.3	7.6	8.9	14
	µg/l	V2M		-0.20	9.34	15	9.20	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		-0.29	36.2	15	35.4	35.7	36.2	1.8	5.1	10
Sb	mg/kg	LO4		1.04	13.5	30	15.6	13.5	14.0	2.2	15.8	9
	µg/l	TN3		0.62	85.5	15	89.5	85.7	85.5	4.4	5.1	12
	µg/l	V2M		0.91	6.28	15	6.71	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		0.05	41.6	10	41.7	41.7	41.6	2.2	5.2	15
	mg/kg	LN4		-2.08	12.8	25	9.5	12.8	12.2	1.5	12.2	7
	µg/l	TN3		0.53	52.8	15	54.9	52.4	52.6	3.9	7.5	12
	µg/l	V2M		0.58	6.41	15	6.69	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LO4		1.62	27.8	20	32.3	27.8	28.2	2.3	8.0	7
	µg/l	TN3		0.65	18.5	20	19.7	18.5	18.1	1.5	8.2	7
	µg/l	V2M		0.00	2.71	20	2.71	2.71	2.80	0.24	8.4	7
Sr	mg/kg	LN4		0.69	97.3	20	104.0	97.3	98.3	6.7	6.8	6
	mg/l	TN3		-0.42	0.22	15	0.21	0.22	0.22	0.02	8.4	9
	µg/l	V2M		-0.15	91.7	10	91.0	92.2	91.7	3.4	3.7	12
S_{tot}	g/kg	L4M		-0.24	11.1	15	10.9	11.0	11.1	0.9	7.8	11
	mg/l	TN3		-0.12	168	10	167	170	168	5	3.1	9
	mg/l	V2M		-0.19	31.7	10	31.4	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		-0.83	50.8	10	48.7	50.4	50.6	2.1	4.1	15
	mg/kg	LN4		0.05	28.2	15	28.3	28.2	28.5	2.0	7.0	6
	µg/l	TN3		1.05	114	15	123	113	114	8	6.8	11
	µg/l	V2M		0.39	8.48	20	8.81	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		-0.78	281	10	270	279	282	18	6.4	19
	mg/kg	LN4		0.61	593	15	620	593	599	33	5.6	9
	µg/l	TN3		1.01	119	15	128	120	119	6	4.8	18
	µg/l	V2M		0.74	52.0	15	54.9	52.4	52.0	2.4	4.7	14

Participant 19												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Cr	µg/l	TN3		0.12	107	15	108	106	107	8	7.9	17
Fe	µg/l	TN3		0.59	521	15	544	526	520	36	6.8	18
Mo	mg/l	TN3		20646.67	1.68	10	1736.00	1.68	1.68	0.07	4.4	13
Ni	µg/l	TN3		-0.63	106	15	101	105	106	10	9.7	18
Zn	µg/l	TN3		-0.56	119	15	114	120	119	6	4.8	18

Participant 20												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-0.60	436	10	423	425	429	27	6.2	19
	g/kg	LN4		0.36	6.26	25	6.54	6.26	5.95	0.82	13.8	7
	g/kg	LO4		-0.04	6.99	20	6.96	6.99	7.06	0.65	9.2	6
	mg/l	TN3		0.36	0.44	15	0.45	0.43	0.44	0.02	4.8	16
	mg/l	TY3		0.18	0.44	20	0.45	0.44	0.46	0.04	9.2	9
	µg/l	V2M		0.19	105	20	107	105	106	5	4.9	15
As	mg/l	A1M		-0.20	40.9	10	40.5	40.5	40.4	1.3	3.2	15
	mg/kg	LN4		-0.30	4.64	30	4.43	4.64	4.60	0.63	13.7	7
	mg/kg	LO4					3.61	4.54	4.07	1.00	24.5	8
	µg/l	TN3		0.08	80.4	15	80.9	79.9	80.0	2.6	3.2	14
	µg/l	TY3		0.05	83.5	15	83.8	83.5	82.5	2.2	2.7	7
	µg/l	V2M		-0.03	7.35	20	7.33	7.38	7.35	0.48	6.6	14
B	mg/kg	LN4			10.3		*<40*	10.8	10.3	1.3	12.4	3
	mg/kg	LO4			10.4	20	*<40*	10.4	10.4	0.9	8.7	6
	mg/l	TN3		0.49	0.26	25	0.28	0.25	0.26	0.03	11.2	12
	mg/l	TY3		0.86	0.29	25	0.32	0.29	0.28	0.04	13.7	7
	µg/l	V2M		0.20	88.8	20	90.6	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LO4		-0.56	161	20	152	161	163	10	6.4	8
	µg/l	TN3		0.11	24.6	15	24.8	24.6	24.3	1.8	7.3	10
	µg/l	TY3		0.42	25.1	15	25.9	25.1	25.1	0.7	3.0	7
	µg/l	V2M		-0.23	35.5	15	34.9	36.3	35.7	1.4	3.9	14
Ca	g/kg	LN4		-0.29	37.0	15	36.2	37.0	37.5	2.1	5.6	6
	g/kg	LO4		-0.88	37.6	20	34.3	37.6	38.2	3.8	10.1	8
	µg/l	TN3		-0.18	66605	10	66000	66600	66605	2050	3.1	13
	µg/l	TY3		1.23	67578	15	73800	67578	67693	4024	5.9	6
	µg/l	V2M		-0.55	32905	10	32000	33065	32871	993	3.0	16
Cd	mg/l	A1M		-0.22	4.82	15	4.74	4.76	4.83	0.26	5.3	18
	mg/kg	LN4		-0.51	0.67	30	0.62	0.67	0.65	0.12	17.6	7
	mg/kg	LO4		-0.11	0.68	30	0.67	0.68	0.73	0.15	21.1	8
	µg/l	TN3		0.00	44.5	15	44.5	44.5	44.8	1.5	3.4	16
	µg/l	TY3		0.17	46.0	15	46.6	46.0	45.9	0.8	1.8	6
	µg/l	V2M		-0.50	5.09	15	4.90	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		-1.07	24.4	10	23.1	24.0	24.0	1.0	4.0	16
	mg/kg	LN4		-1.29	6.19	25	5.19	6.19	6.24	0.61	9.8	7
	mg/kg	LO4		-1.24	6.47	25	5.47	6.47	6.21	1.09	17.5	8
	µg/l	TN3		0.28	57.7	20	59.3	57.6	57.7	4.5	7.9	15
	µg/l	TY3		0.00	60.2	15	60.2	60.2	59.4	3.6	6.1	7
	µg/l	V2M		-0.87	4.27	15	3.99	4.29	4.30	0.21	5.0	14

Participant 20												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Cr	mg/l	A1M		-0.92	39.0	10	37.2	38.8	38.8	1.4	3.6	19
	mg/kg	LN4		-0.37	29.9	20	28.8	29.9	29.8	2.6	8.8	8
	mg/kg	LO4		0.18	32.7	20	33.3	32.7	32.3	2.9	8.9	9
	µg/l	TN3		-0.77	107	15	101	106	107	8	7.9	17
	µg/l	TY3		-0.38	105	15	102	105	106	4	4.1	9
	µg/l	V2M		-0.33	9.75	15	9.51	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		-0.83	40.9	10	39.2	40.5	40.4	1.9	4.8	17
	mg/kg	LN4		-1.04	385	20	345	385	393	27	6.8	9
	mg/kg	LO4		-0.51	392	20	372	392	392	11	2.9	9
	µg/l	TN3		0.00	77.1	15	77.1	77.1	76.6	4.1	5.3	18
	µg/l	TY3		0.08	79.6	15	80.1	79.6	78.3	4.9	6.3	8
	µg/l	V2M		-0.55	9.86	20	9.32	9.85	9.95	0.56	5.7	17
Drw	%	L4M		0.30	93.8	5	94.5	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		0.08	515	10	517	516	514	29	5.7	19
	g/kg	LN4		20.00	115	20	345	115	118	19	16.2	6
	g/kg	LO4		-0.17	118	20	116	118	119	5	4.3	8
	µg/l	TN3		0.08	521	15	524	526	520	36	6.8	18
	µg/l	TY3		0.27	536	15	547	536	535	33	6.2	9
	mg/l	V2M		0.07	0.79	15	0.79	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		0.12	0.67	20	0.68	0.67	0.66	0.06	8.7	12
	µg/l	T3Hg		-1.57	2.67	20	2.25	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		0.65	2.16	20	2.30	2.11	2.14	0.20	9.5	14
Mg	g/kg	LN4		-0.23	3.99	20	3.90	3.99	4.03	0.31	7.8	7
	g/kg	LO4		-1.04	4.09	15	3.77	4.09	4.10	0.20	4.9	8
	µg/l	TN3		-0.76	21309	10	20500	21395	21253	803	3.8	14
	µg/l	TY3		-13.25	22200	15	141	22200	21911	1366	6.2	6
	µg/l	V2M		-0.46	8035	10	7850	8020	8061	361	4.5	17
Mn	mg/l	A1M		-1.14	297	10	280	301	301	14	4.7	20
	mg/kg	LN4		-0.70	330	25	301	330	330	36	10.8	8
	mg/kg	LO4		-0.51	332	20	315	330	332	13	3.8	8
	µg/l	TN3		0.29	138	10	140	140	140	5	3.6	15
	µg/l	TY3		0.29	138	15	141	138	137	9	6.3	8
	mg/l	V2M		-0.47	0.20	15	0.19	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LN4		0.32	5.94	25	6.18	6.34	5.94	1.15	19.3	8
	mg/kg	LO4		-0.38	6.18	25	5.89	6.25	6.18	0.77	12.5	9
	mg/l	TN3		0.00	1.68	10	1.68	1.68	1.68	0.07	4.4	13
	mg/l	TY3		-0.61	1.75	15	1.67	1.75	1.76	0.10	5.5	7
	µg/l	V2M		0.00	26.9	15	26.9	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		-0.97	47.5	10	45.2	47.0	47.1	2.4	5.1	19
	mg/kg	LN4		-1.20	21.6	20	19.0	21.6	21.6	1.7	7.9	8
	mg/kg	LO4		-0.64	22.5	25	20.7	22.5	22.3	3.6	16.2	9
	µg/l	TN3		0.00	106	15	106	105	106	10	9.7	18
	µg/l	TY3		0.24	109	15	111	109	109	6	5.9	7
	µg/l	V2M		-0.03	9.64	15	9.62	9.67	9.61	0.51	5.3	14
N_{tot}	g/kg	L4M		-0.59	28.2	15	27.0	28.2	27.6	1.8	6.5	10
Pb	mg/l	A1M		-0.70	45.5	10	43.9	44.8	45.3	2.5	5.5	18
	mg/kg	LN4		-0.86	17.7	25	15.8	17.7	19.4	3.1	16.1	7
	mg/kg	LO4		-1.06	18.1	25	15.7	18.1	18.1	1.7	9.3	8

Participant 20												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Pb	µg/l	TN3		-1.03	90.6	15	83.6	83.9	85.3	7.6	8.9	14
	µg/l	TY3		0.17	88.2	15	89.3	88.2	87.7	4.2	4.8	8
	µg/l	V2M		-1.30	9.34	15	8.43	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		-0.74	36.2	15	34.2	35.7	36.2	1.8	5.1	10
Sb	mg/kg	LN4			9.56		9.26	9.56	9.68	0.94	9.7	4
	mg/kg	LO4		-0.35	13.5	30	12.8	13.5	14.0	2.2	15.8	9
	µg/l	TN3		0.09	85.5	15	86.1	85.7	85.5	4.4	5.1	12
	µg/l	TY3		0.32	88.3	15	90.4	88.3	86.7	4.7	5.4	7
	µg/l	V2M		-0.45	6.28	15	6.07	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		-0.82	41.6	10	39.9	41.7	41.6	2.2	5.2	15
	mg/kg	LN4		-1.06	12.8	25	11.1	12.8	12.2	1.5	12.2	7
	mg/kg	LO4		-0.87	12.3	30	10.7	12.3	11.7	2.0	16.8	8
	µg/l	TN3		-0.45	52.8	15	51.0	52.4	52.6	3.9	7.5	12
	µg/l	TY3		-0.39	54.3	15	52.7	54.3	54.3	1.3	2.5	6
	µg/l	V2M		-0.92	6.41	15	5.97	6.41	6.37	0.52	8.2	13
Sn	µg/l	TN3		0.00	18.5	20	18.5	18.5	18.1	1.5	8.2	7
	µg/l	TY3			17.3		19.3	17.3	17.5	1.3	7.4	4
	µg/l	V2M		-0.04	2.71	20	2.70	2.71	2.80	0.24	8.4	7
Sr	mg/kg	LN4		0.00	97.3	20	97.3	97.3	98.3	6.7	6.8	6
	mg/kg	LO4		-1.49	98.0	20	83.4	98.0	98.0	7.8	7.9	7
	mg/l	TN3		0.73	0.22	15	0.23	0.22	0.22	0.02	8.4	9
	mg/l	TY3		1.09	0.22	15	0.24	0.22	0.22	0.01	5.8	6
	µg/l	V2M		0.81	91.7	10	95.4	92.2	91.7	3.4	3.7	12
S_{tot}	g/kg	L4M		-0.96	11.1	15	10.3	11.0	11.1	0.9	7.8	11
	mg/l	TN3		20575.24	168	10	173000	170	168	5	3.1	9
	mg/l	TY3			170		166000	170	168	19	11.5	5
	mg/l	V2M		20863.28	31.7	10	33100.0	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		-0.59	50.8	10	49.3	50.4	50.6	2.1	4.1	15
	mg/kg	LN4		-1.04	28.2	15	26.0	28.2	28.5	2.0	7.0	6
	mg/kg	LO4		-0.77	30.0	20	27.7	30.0	30.4	3.1	10.3	7
	µg/l	TN3		-0.23	114	15	112	113	114	8	6.8	11
	µg/l	TY3		0.58	115	15	120	115	115	5	4.5	7
	µg/l	V2M		-0.54	8.48	20	8.02	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		-0.64	281	10	272	279	282	18	6.4	19
	mg/kg	LN4		-0.56	593	15	568	593	599	33	5.6	9
	mg/kg	LO4		-0.47	595	15	574	595	588	31	5.2	9
	µg/l	TN3		-0.22	119	15	117	120	119	6	4.8	18
	µg/l	TY3		-0.22	121	15	119	121	122	3	2.8	7
	µg/l	V2M		-0.87	52.0	15	48.6	52.4	52.0	2.4	4.7	14

Participant 21												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-3.53	436	10	359	425	429	27	6.2	19
	g/kg	LN4		-2.34	6.26	25	4.43	6.26	5.95	0.82	13.8	7
	mg/l	TN3		1.06	0.44	15	0.48	0.43	0.44	0.02	4.8	16
	µg/l	V2M		0.29	105	20	108	105	106	5	4.9	15
As	mg/l	A1M		-0.10	40.9	10	40.7	40.5	40.4	1.3	3.2	15
	mg/kg	LN4		0.00	4.64	30	4.64	4.64	4.60	0.63	13.7	7

Participant 21												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
As	µg/l	TN3		1.71	80.4	15	90.7	79.9	80.0	2.6	3.2	14
	µg/l	V2M		0.71	7.35	20	7.87	7.38	7.35	0.48	6.6	14
B	mg/kg	LN4			10.3		8.9	10.8	10.3	1.3	12.4	3
	mg/l	TN3		0.03	0.26	25	0.26	0.25	0.26	0.03	11.2	12
	µg/l	V2M		0.98	88.8	20	97.5	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LN4		0.12	161	20	163	161	163	16	10.0	6
	µg/l	TN3		0.49	24.6	15	25.5	24.6	24.3	1.8	7.3	10
	µg/l	V2M		0.23	35.5	15	36.1	36.3	35.7	1.4	3.9	14
Ca	g/kg	LN4		-0.40	37.0	15	35.9	37.0	37.5	2.1	5.6	6
	µg/l	TN3		-0.81	66605	10	63900	66600	66605	2050	3.1	13
	µg/l	V2M		-1.28	32905	10	30800	33065	32871	993	3.0	16
Cd	mg/l	A1M		-0.75	4.82	15	4.55	4.76	4.83	0.26	5.3	18
	mg/kg	LN4		1.33	0.67	30	0.80	0.67	0.65	0.12	17.6	7
	µg/l	TN3		0.00	44.5	15	44.5	44.5	44.8	1.5	3.4	16
	µg/l	V2M		0.03	5.09	15	5.10	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		-1.31	24.4	10	22.8	24.0	24.0	1.0	4.0	16
	mg/kg	LN4		-0.39	6.19	25	5.89	6.19	6.24	0.61	9.8	7
	µg/l	TN3		1.37	57.7	20	65.6	57.6	57.7	4.5	7.9	15
	µg/l	V2M		0.94	4.27	15	4.57	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		-1.23	39.0	10	36.6	38.8	38.8	1.4	3.6	19
	mg/kg	LN4		-1.17	29.9	20	26.4	29.9	29.8	2.6	8.8	8
	µg/l	TN3		1.62	107	15	120	106	107	8	7.9	17
	µg/l	V2M		0.75	9.75	15	10.30	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		-1.66	40.9	10	37.5	40.5	40.4	1.9	4.8	17
	mg/kg	LN4		0.60	385	20	408	385	393	27	6.8	9
	µg/l	TN3		1.25	77.1	15	84.3	77.1	76.6	4.1	5.3	18
	µg/l	V2M		0.95	9.86	20	10.80	9.85	9.95	0.56	5.7	17
Drw	%	L4M		-0.64	93.8	5	92.3	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		-1.86	515	10	467	516	514	29	5.7	19
	g/kg	LN4		0.09	115	20	116	115	118	19	16.2	6
	µg/l	TN3		1.74	521	15	589	526	520	36	6.8	18
	mg/l	V2M		0.69	0.79	15	0.83	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		-0.72	0.67	20	0.62	0.67	0.66	0.06	8.7	12
	mg/kg	LN4			0.53		0.61	0.54	0.53	0.07	13.5	4
	µg/l	T3Hg		-1.65	2.67	20	2.23	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		-0.60	2.16	20	2.03	2.11	2.14	0.20	9.5	14
Mg	g/kg	LN4		-0.98	3.99	20	3.60	3.99	4.03	0.31	7.8	7
	µg/l	TN3		-0.20	21309	10	21100	21395	21253	803	3.8	14
	µg/l	V2M		0.04	8035	10	8050	8020	8061	361	4.5	17
Mn	mg/l	A1M		-1.14	297	10	280	301	301	14	4.7	20
	mg/kg	LN4		-0.07	330	25	327	330	330	36	10.8	8
	µg/l	TN3		1.88	138	10	151	140	140	5	3.6	15
	mg/l	V2M		13920.00	0.20	15	209.00	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LN4		1.12	5.94	25	6.77	6.34	5.94	1.15	19.3	8
	mg/l	TN3		1.31	1.68	10	1.79	1.68	1.68	0.07	4.4	13
	µg/l	V2M		0.50	26.9	15	27.9	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		-1.14	47.5	10	44.8	47.0	47.1	2.4	5.1	19
	mg/kg	LN4		-0.56	21.6	20	20.4	21.6	21.6	1.7	7.9	8

Participant 21												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Ni	µg/l	TN3		1.01	106	15	114	105	106	10	9.7	18
	µg/l	V2M		0.10	9.64	15	9.71	9.67	9.61	0.51	5.3	14
N_{tot}	g/kg	L4M		0.57	28.2	15	29.4	28.2	27.6	1.8	6.5	10
Pb	mg/l	A1M		-0.97	45.5	10	43.3	44.8	45.3	2.5	5.5	18
	mg/kg	LN4		0.00	17.7	25	17.7	17.7	19.4	3.1	16.1	7
	µg/l	TN3		-0.96	90.6	15	84.1	83.9	85.3	7.6	8.9	14
	µg/l	V2M		-1.41	9.34	15	8.35	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		0.96	36.2	15	38.8	35.7	36.2	1.8	5.1	10
Sb	mg/kg	LN4			9.56		9.85	9.56	9.68	0.94	9.7	4
	µg/l	TN3		-0.55	85.5	15	82.0	85.7	85.5	4.4	5.1	12
	µg/l	V2M		-0.89	6.28	15	5.86	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		-2.16	41.6	10	37.1	41.7	41.6	2.2	5.2	15
	mg/kg	LN4		0.06	12.8	25	12.9	12.8	12.2	1.5	12.2	7
	µg/l	TN3		1.64	52.8	15	59.3	52.4	52.6	3.9	7.5	12
	µg/l	V2M		1.10	6.41	15	6.94	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LN4					14.9	21.3	21.4	6.6	30.8	3
	µg/l	TN3		0.11	18.5	20	18.7	18.5	18.1	1.5	8.2	7
	µg/l	V2M		-0.11	2.71	20	2.68	2.71	2.80	0.24	8.4	7
Sr	mg/kg	LN4		-0.14	97.3	20	95.9	97.3	98.3	6.7	6.8	6
	mg/l	TN3		1.21	0.22	15	0.24	0.22	0.22	0.02	8.4	9
	µg/l	V2M		0.48	91.7	10	93.9	92.2	91.7	3.4	3.7	12
S_{tot}	mg/l	TN3		-17.63	168	10	20	170	168	5	3.1	9
	mg/l	V2M		-17.66	31.7	10	3.7	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		-0.94	50.8	10	48.4	50.4	50.6	2.1	4.1	15
	mg/kg	LN4		-0.38	28.2	15	27.4	28.2	28.5	2.0	7.0	6
	µg/l	TN3		-13.32	114	15	0	113	114	8	6.8	11
	µg/l	V2M		0.57	8.48	20	8.96	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		-1.71	281	10	257	279	282	18	6.4	19
	mg/kg	LN4		-0.25	593	15	582	593	599	33	5.6	9
	µg/l	TN3		0.67	119	15	125	120	119	6	4.8	18
	µg/l	V2M		0.36	52.0	15	53.4	52.4	52.0	2.4	4.7	14

Participant 22												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		0.41	436	10	445	425	429	27	6.2	19
	g/kg	LN4		0.00	6.26	25	6.26	6.26	5.95	0.82	13.8	7
	mg/l	TY3		0.07	0.44	20	0.44	0.44	0.46	0.04	9.2	9
	µg/l	V2M		1.24	105	20	118	105	106	5	4.9	15
As	mg/l	A1M		1.02	40.9	10	43.0	40.5	40.4	1.3	3.2	15
	mg/kg	LN4		1.45	4.64	30	5.65	4.64	4.60	0.63	13.7	7
	µg/l	TY3		0.17	83.5	15	84.6	83.5	82.5	2.2	2.7	7
	µg/l	V2M		-0.18	7.35	20	7.22	7.38	7.35	0.48	6.6	14
B	mg/l	TY3		0.33	0.29	25	0.30	0.29	0.28	0.04	13.7	7
Ba	mg/kg	LN4		1.65	161	20	188	161	163	16	10.0	6
	µg/l	TY3		-0.09	25.1	15	24.9	25.1	25.1	0.7	3.0	7
	µg/l	V2M		0.34	35.5	15	36.4	36.3	35.7	1.4	3.9	14

Participant 22												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Ca	g/kg	LN4		1.40	37.0	15	40.9	37.0	37.5	2.1	5.6	6
	µg/l	TY3		0.11	67578	15	68155	67578	67693	4024	5.9	6
	µg/l	V2M		0.57	32905	10	33847	33065	32871	993	3.0	16
Cd	mg/l	A1M		0.30	4.82	15	4.93	4.76	4.83	0.26	5.3	18
	mg/kg	LN4		-0.25	0.67	30	0.65	0.67	0.65	0.12	17.6	7
	µg/l	TY3		-0.41	46.0	15	44.6	46.0	45.9	0.8	1.8	6
	µg/l	V2M		-0.30	5.09	15	4.98	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		1.02	24.4	10	25.6	24.0	24.0	1.0	4.0	16
	mg/kg	LN4		0.76	6.19	25	6.78	6.19	6.24	0.61	9.8	7
	µg/l	TY3		0.38	60.2	15	61.9	60.2	59.4	3.6	6.1	7
	µg/l	V2M		0.84	4.27	15	4.54	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		0.78	39.0	10	40.5	38.8	38.8	1.4	3.6	19
	mg/kg	LN4		0.90	29.9	20	32.6	29.9	29.8	2.6	8.8	8
	µg/l	TY3		0.79	105	15	111	105	106	4	4.1	9
	µg/l	V2M		0.14	9.75	15	9.85	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		0.84	40.9	10	42.6	40.5	40.4	1.9	4.8	17
	mg/kg	LN4		1.45	385	20	441	385	393	27	6.8	9
	µg/l	TY3		0.16	79.6	15	80.6	79.6	78.3	4.9	6.3	8
	µg/l	V2M		1.16	9.86	20	11.00	9.85	9.95	0.56	5.7	17
Fe	mg/l	A1M		2.60	515	10	582	516	514	29	5.7	19
	g/kg	LN4		2.54	115	20	144	115	118	19	16.2	6
	µg/l	TY3		1.21	536	15	585	536	535	33	6.2	9
	mg/l	V2M		2.68	0.79	15	0.95	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		4.21	0.67	20	0.95	0.67	0.66	0.06	8.7	12
	mg/kg	LN4			0.53		0.55	0.54	0.53	0.07	13.5	4
	µg/l	T3Hg		-0.37	2.67	20	2.57	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		-0.60	2.16	20	2.03	2.11	2.14	0.20	9.5	14
Mg	g/kg	LN4		0.88	3.99	20	4.34	3.99	4.03	0.31	7.8	7
	µg/l	TY3		0.36	22200	15	22798	22200	21911	1366	6.2	6
	µg/l	V2M		1.53	8035	10	8651	8020	8061	361	4.5	17
Mn	mg/l	A1M		1.35	297	10	317	301	301	14	4.7	20
	mg/kg	LN4		1.42	330	25	389	330	330	36	10.8	8
	µg/l	TY3		1.34	138	15	152	138	137	9	6.3	8
	mg/l	V2M		1.33	0.20	15	0.22	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LN4		1.93	5.94	25	7.37	6.34	5.94	1.15	19.3	8
	mg/l	TY3		0.04	1.75	15	1.76	1.75	1.76	0.10	5.5	7
	µg/l	V2M		0.73	26.9	15	28.4	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		1.06	47.5	10	50.0	47.0	47.1	2.4	5.1	19
	mg/kg	LN4		1.00	21.6	20	23.8	21.6	21.6	1.7	7.9	8
	µg/l	TY3		0.09	109	15	110	109	109	6	5.9	7
Pb	mg/l	A1M		2.44	45.5	10	51.1	44.8	45.3	2.5	5.5	18
	mg/kg	LN4		1.51	17.7	25	21.1	17.7	19.4	3.1	16.1	7
	µg/l	TY3		0.37	88.2	15	90.7	88.2	87.7	4.2	4.8	8
	µg/l	V2M		-0.27	9.34	15	9.15	8.58	8.64	0.44	5.1	13
Sb	mg/kg	LO4		-0.40	13.5	30	12.7	13.5	14.0	2.2	15.8	9
	µg/l	TY3		0.19	88.3	15	89.5	88.3	86.7	4.7	5.4	7
	µg/l	V2M		1.00	6.28	15	6.75	6.32	6.34	0.38	6.0	13

Participant 22												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Se	mg/l	A1M		0.39	41.6	10	42.4	41.7	41.6	2.2	5.2	15
	mg/kg	LN4		0.59	12.8	25	13.7	12.8	12.2	1.5	12.2	7
	µg/l	TY3		-0.27	54.3	15	53.2	54.3	54.3	1.3	2.5	6
	µg/l	V2M		-0.71	6.41	15	6.07	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LO4		-0.32	27.8	20	26.9	27.8	28.2	2.3	8.0	7
Sr	mg/kg	LN4		1.01	97.3	20	107.1	97.3	98.3	6.7	6.8	6
	mg/l	TY3		0.30	0.22	15	0.23	0.22	0.22	0.01	5.8	6
	µg/l	V2M		0.10	91.7	10	92.2	92.2	91.7	3.4	3.7	12
S_{tot}	g/kg	L4M		1.87	11.1	15	12.7	11.0	11.1	0.9	7.8	11
	mg/l	TY3			170		195	170	168	19	11.5	5
	mg/l	V2M		0.09	31.7	10	31.8	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		0.69	50.8	10	52.6	50.4	50.6	2.1	4.1	15
	mg/kg	LN4		1.74	28.2	15	31.9	28.2	28.5	2.0	7.0	6
	µg/l	TY3		0.56	115	15	120	115	115	5	4.5	7
	µg/l	V2M		-0.11	8.48	20	8.39	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		1.09	281	10	296	279	282	18	6.4	19
	mg/kg	LN4		1.30	593	15	651	593	599	33	5.6	9
	µg/l	TY3		0.03	121	15	121	121	122	3	2.8	7

Participant 23												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		1.30	436	10	464	425	429	27	6.2	19
	g/kg	LO4		0.31	6.99	20	7.21	6.99	7.06	0.65	9.2	6
	mg/l	TY3		1.95	0.44	20	0.53	0.44	0.46	0.04	9.2	9
	µg/l	V2M		0.07	105	20	106	105	106	5	4.9	15
As	mg/l	A1M		19894.26	40.9	10	40724.7	40.5	40.4	1.3	3.2	15
	mg/kg	LO4					5.02	4.54	4.07	1.00	24.5	8
	µg/l	TY3		0.00	83.5	15	83.5	83.5	82.5	2.2	2.7	7
	µg/l	V2M		1.03	7.35	20	8.11	7.38	7.35	0.48	6.6	14
B	mg/kg	LO4		-0.13	10.4	20	10.3	10.4	10.4	0.9	8.7	6
	mg/l	TY3		0.06	0.29	25	0.29	0.29	0.28	0.04	13.7	7
	µg/l	V2M		1.29	88.8	20	100.2	90.6	88.2	10.2	11.5	15
Ba	mg/kg	LO4		1.02	161	20	177	161	163	10	6.4	8
	µg/l	TY3		0.47	25.1	15	26.0	25.1	25.1	0.7	3.0	7
	µg/l	V2M		0.53	35.5	15	36.9	36.3	35.7	1.4	3.9	14
Ca	g/kg	LO4		0.50	37.6	20	39.5	37.6	38.2	3.8	10.1	8
	µg/l	TY3		0.54	67578	15	70313	67578	67693	4024	5.9	6
	µg/l	V2M		0.64	32905	10	33956	33065	32871	993	3.0	16
Cd	mg/l	A1M		12736.32	4.82	15	4609.00	4.76	4.83	0.26	5.3	18
	mg/kg	LO4		-1.30	0.68	30	0.55	0.68	0.73	0.15	21.1	8
	µg/l	TY3		-0.12	46.0	15	45.6	46.0	45.9	0.8	1.8	6
	µg/l	V2M		0.29	5.09	15	5.20	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		-0.06	24.4	10	24.3	24.0	24.0	1.0	4.0	16
	mg/kg	LO4		0.63	6.47	25	6.98	6.47	6.21	1.09	17.5	8
	µg/l	TY3		0.67	60.2	15	63.2	60.2	59.4	3.6	6.1	7
	µg/l	V2M		-0.27	4.27	15	4.18	4.29	4.30	0.21	5.0	14
Cr	mg/l	A1M		0.14	39.0	10	39.3	38.8	38.8	1.4	3.6	19
	mg/kg	LO4		1.29	32.7	20	36.9	32.7	32.3	2.9	8.9	9

Participant 23												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Cr	µg/l	TY3		0.62	105	15	110	105	106	4	4.1	9
	µg/l	V2M		-1.49	9.75	15	8.66	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		19461.66	40.9	10	39840.0	40.5	40.4	1.9	4.8	17
	mg/kg	LO4		0.38	392	20	407	392	392	11	2.9	9
	µg/l	TY3		0.37	79.6	15	81.8	79.6	78.3	4.9	6.3	8
	µg/l	V2M		-0.60	9.86	20	9.27	9.85	9.95	0.56	5.7	17
Drw	%	L4M		-0.45	93.8	5	92.8	93.8	93.7	1.9	2.0	15
Fe	mg/l	A1M		20137.20	515	10	519048	516	514	29	5.7	19
	g/kg	LO4		0.31	118	20	122	118	119	5	4.3	8
	µg/l	TY3		0.77	536	15	567	536	535	33	6.2	9
	mg/l	V2M		0.84	0.79	15	0.84	0.79	0.79	0.04	5.2	14
Hg	µg/l	A1Hg		-0.90	0.67	20	0.61	0.67	0.66	0.06	8.7	12
	mg/kg	LO4		5.31	0.52	20	0.80	0.52	0.52	0.02	3.4	6
	µg/l	T3Hg		1.70	2.67	20	3.12	2.58	2.60	0.29	11.1	17
	µg/l	V2Hg		-0.35	2.16	20	2.08	2.11	2.14	0.20	9.5	14
Mg	g/kg	LO4		0.66	4.09	15	4.29	4.09	4.10	0.20	4.9	8
	µg/l	TY3		0.88	22200	15	23659	22200	21911	1366	6.2	6
	µg/l	V2M		2.28	8035	10	8950	8020	8061	361	4.5	17
Mn	mg/l	A1M		0.94	297	10	311	301	301	14	4.7	20
	mg/kg	LO4		0.61	332	20	352	330	332	13	3.8	8
	µg/l	TY3		0.39	138	15	142	138	137	9	6.3	8
	mg/l	V2M		0.33	0.20	15	0.21	0.20	0.20	0.01	4.9	14
Mo	mg/kg	LO4		0.29	6.18	25	6.41	6.25	6.18	0.77	12.5	9
	mg/l	TY3		-0.02	1.75	15	1.75	1.75	1.76	0.10	5.5	7
	µg/l	V2M		-1.44	26.9	15	24.0	26.9	27.0	1.6	6.0	15
Ni	mg/l	A1M		20208.63	47.5	10	48043.0	47.0	47.1	2.4	5.1	19
	mg/kg	LO4		0.78	22.5	25	24.7	22.5	22.3	3.6	16.2	9
	µg/l	TY3		1.43	109	15	121	109	109	6	5.9	7
	µg/l	V2M		-1.83	9.64	15	8.32	9.67	9.61	0.51	5.3	14
Pb	mg/l	A1M		20456.48	45.5	10	46584.0	44.8	45.3	2.5	5.5	18
	mg/kg	LO4		1.29	18.1	25	21.0	18.1	18.1	1.7	9.3	8
	µg/l	TY3		-0.80	88.2	15	82.9	88.2	87.7	4.2	4.8	8
	µg/l	V2M		-1.38	9.34	15	8.37	8.58	8.64	0.44	5.1	13
P_{tot}	g/kg	L4M		0.26	36.2	15	36.9	35.7	36.2	1.8	5.1	10
Sb	mg/kg	LO4		-1.07	13.5	30	11.3	13.5	14.0	2.2	15.8	9
	µg/l	TY3		0.00	88.3	15	88.3	88.3	86.7	4.7	5.4	7
	µg/l	V2M		-0.11	6.28	15	6.23	6.32	6.34	0.38	6.0	13
Se	mg/l	A1M		-0.50	41.6	10	40.6	41.7	41.6	2.2	5.2	15
	mg/kg	LO4		0.71	12.3	30	13.6	12.3	11.7	2.0	16.8	8
	µg/l	TY3		0.54	54.3	15	56.5	54.3	54.3	1.3	2.5	6
	µg/l	V2M		0.61	6.41	15	6.70	6.41	6.37	0.52	8.2	13
Sn	mg/kg	LO4		-1.01	27.8	20	25.0	27.8	28.2	2.3	8.0	7
	µg/l	TY3			17.3		17.4	17.3	17.5	1.3	7.4	4
	µg/l	V2M		-0.63	2.71	20	2.54	2.71	2.80	0.24	8.4	7
Sr	mg/kg	LO4		0.98	98.0	20	107.6	98.0	98.0	7.8	7.9	7
	mg/l	TY3		1.09	0.22	15	0.24	0.22	0.22	0.01	5.8	6
	µg/l	V2M		1.02	91.7	10	96.4	92.2	91.7	3.4	3.7	12

Participant 23												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
S_{tot}	g/kg	L4M		0.36	11.1	15	11.4	11.0	11.1	0.9	7.8	11
	mg/l	TY3			170		173	170	168	19	11.5	5
	mg/l	V2M		0.09	31.7	10	31.8	31.8	31.6	1.2	3.9	13
V	mg/l	A1M		-0.45	50.8	10	49.6	50.4	50.6	2.1	4.1	15
	mg/kg	LO4		1.54	30.0	20	34.6	30.0	30.4	3.1	10.3	7
	µg/l	TY3		0.68	115	15	121	115	115	5	4.5	7
	µg/l	V2M		-0.97	8.48	20	7.65	8.39	8.52	0.67	7.8	13
Zn	mg/l	A1M		20827.69	281	10	292910	279	282	18	6.4	19
	mg/kg	LO4		0.30	595	15	608	595	588	31	5.2	9
	µg/l	TY3		0.71	121	15	127	121	122	3	2.8	7
	µg/l	V2M		13927.95	52.0	15	54371.0	52.4	52.0	2.4	4.7	14

Participant 24												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Zn	µg/l	TY3		0.44	121	15	125	121	122	3	2.8	7

Participant 25												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		0.00	436	10	436	425	429	27	6.2	19
	mg/l	TN3		-0.27	0.44	15	0.43	0.43	0.44	0.02	4.8	16
As	mg/l	A1M		-0.09	40.9	10	40.7	40.5	40.4	1.3	3.2	15
Ca	µg/l	TN3		0.57	66605	10	68515	66600	66605	2050	3.1	13
Cd	mg/l	A1M		-0.14	4.82	15	4.77	4.76	4.83	0.26	5.3	18
	µg/l	TN3		-0.06	44.5	15	44.3	44.5	44.8	1.5	3.4	16
Co	mg/l	A1M		-18.03	24.4	10	2.4	24.0	24.0	1.0	4.0	16
	µg/l	TN3		0.50	57.7	20	60.6	57.6	57.7	4.5	7.9	15
Cr	mg/l	A1M		-0.14	39.0	10	38.7	38.8	38.8	1.4	3.6	19
	µg/l	TN3		-0.26	107	15	105	106	107	8	7.9	17
Cu	µg/l	TN3		0.00	77.1	15	77.1	77.1	76.6	4.1	5.3	18
Fe	mg/l	A1M		0.11	515	10	518	516	514	29	5.7	19
	µg/l	TN3		-0.17	521	15	515	526	520	36	6.8	18
Mn	mg/l	A1M		-0.24	297	10	294	301	301	14	4.7	20
Mo	mg/l	TN3		-0.71	1.68	10	1.62	1.68	1.68	0.07	4.4	13
Ni	mg/l	A1M		-1.89	47.5	10	43.0	47.0	47.1	2.4	5.1	19
	µg/l	TN3		3.21	106	15	132	105	106	10	9.7	18
Pb	mg/l	A1M		-0.34	45.5	10	44.7	44.8	45.3	2.5	5.5	18
Zn	mg/l	A1M		-0.33	281	10	276	279	282	18	6.4	19
	µg/l	TN3		0.65	119	15	125	120	119	6	4.8	18

Participant 26												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		1.06	436	10	459	425	429	27	6.2	19
	mg/l	TN3		-0.06	0.44	15	0.44	0.43	0.44	0.02	4.8	16
	µg/l	V2M		0.00	105	20	105	105	106	5	4.9	15
As	mg/l	A1M		0.93	40.9	10	42.8	40.5	40.4	1.3	3.2	15
	µg/l	TN3		-0.30	80.4	15	78.6	79.9	80.0	2.6	3.2	14
B	mg/l	TN3		-1.23	0.26	25	0.22	0.25	0.26	0.03	11.2	12
	µg/l	V2M		-2.44	88.8	20	67.1	90.6	88.2	10.2	11.5	15

Participant 26												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Ca	µg/l	TN3		0.75	66605	10	69100	66600	66605	2050	3.1	13
	µg/l	V2M		-0.37	32905	10	32300	33065	32871	993	3.0	16
Cd	mg/l	A1M		-0.33	4.82	15	4.70	4.76	4.83	0.26	5.3	18
	µg/l	TN3		0.48	44.5	15	46.1	44.5	44.8	1.5	3.4	16
	µg/l	V2M		0.68	5.09	15	5.35	5.08	5.08	0.25	4.9	16
Co	mg/l	A1M		0.49	24.4	10	25.0	24.0	24.0	1.0	4.0	16
	µg/l	TN3		-1.32	57.7	20	50.1	57.6	57.7	4.5	7.9	15
Cr	mg/l	A1M		0.77	39.0	10	40.5	38.8	38.8	1.4	3.6	19
	µg/l	TN3		0.50	107	15	111	106	107	8	7.9	17
	µg/l	V2M		-0.21	9.75	15	9.60	9.85	9.72	0.43	4.4	16
Cu	mg/l	A1M		0.34	40.9	10	41.6	40.5	40.4	1.9	4.8	17
	µg/l	TN3		0.14	77.1	15	77.9	77.1	76.6	4.1	5.3	18
	µg/l	V2M		-2.24	9.86	20	7.65	9.85	9.95	0.56	5.7	17
Fe	mg/l	A1M		1.20	515	10	546	516	514	29	5.7	19
	µg/l	TN3		0.84	521	15	554	526	520	36	6.8	18
	mg/l	V2M		0.78	0.79	15	0.84	0.79	0.79	0.04	5.2	14
Mg	µg/l	TN3		0.27	21309	10	21600	21395	21253	803	3.8	14
	µg/l	V2M		0.21	8035	10	8120	8020	8061	361	4.5	17
Mn	mg/l	A1M		1.55	297	10	320	301	301	14	4.7	20
	µg/l	TN3		0.29	138	10	140	140	140	5	3.6	15
	mg/l	V2M		0.53	0.20	15	0.21	0.20	0.20	0.01	4.9	14
Ni	mg/l	A1M		0.88	47.5	10	49.6	47.0	47.1	2.4	5.1	19
	µg/l	TN3		-0.13	106	15	105	105	106	10	9.7	18
Pb	mg/l	A1M		1.01	45.5	10	47.8	44.8	45.3	2.5	5.5	18
	µg/l	TN3		-7.74	90.6	15	38.0	83.9	85.3	7.6	8.9	14
Sr	mg/l	TN3		-2.30	0.22	15	0.18	0.22	0.22	0.02	8.4	9
	µg/l	V2M		-9.16	91.7	10	49.7	92.2	91.7	3.4	3.7	12
S_{tot}	mg/l	TN3		-1.31	168	10	157	170	168	5	3.1	9
	mg/l	V2M		-1.77	31.7	10	28.9	31.8	31.6	1.2	3.9	13
Zn	mg/l	A1M		0.50	281	10	288	279	282	18	6.4	19
	µg/l	TN3		0.11	119	15	120	120	119	6	4.8	18
	µg/l	V2M		-0.54	52.0	15	49.9	52.4	52.0	2.4	4.7	14

Participant 27												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Al	mg/l	A1M		-0.50	436	10	425	425	429	27	6.2	19
	mg/l	TN3		0.55	0.44	15	0.46	0.43	0.44	0.02	4.8	16
	µg/l	V2M		0.38	105	20	109	105	106	5	4.9	15
Ca	µg/l	TN3		0.42	66605	10	68000	66600	66605	2050	3.1	13
	µg/l	V2M		0.24	32905	10	33300	33065	32871	993	3.0	16
Cr	mg/kg	LN4		-1.24	29.9	20	26.2	29.9	29.8	2.6	8.8	8
Cu	mg/l	A1M		-0.24	40.9	10	40.4	40.5	40.4	1.9	4.8	17
	mg/kg	LN4		0.34	385	20	398	385	393	27	6.8	9
	µg/l	TN3		0.24	77.1	15	78.5	77.1	76.6	4.1	5.3	18
	µg/l	V2M		-0.15	9.86	20	9.71	9.85	9.95	0.56	5.7	17

Participant 27												
Measurand	Unit	Sample	-3 0 3	z score	Assigned value	2×s_{pt} %	Participant's result	Md	Mean	sd	sd %	n (stat)
Fe	mg/l	A1M		-0.78	515	10	495	516	514	29	5.7	19
	g/kg	LN4		-0.17	115	20	113	115	118	19	16.2	6
	µg/l	TN3		0.05	521	15	523	526	520	36	6.8	18
	mg/l	V2M		0.00	0.79	15	0.79	0.79	0.79	0.04	5.2	14
Mg	µg/l	TN3		0.46	21309	10	21800	21395	21253	803	3.8	14
	µg/l	V2M		0.46	8035	10	8220	8020	8061	361	4.5	17
Mn	mg/l	A1M		0.07	297	10	298	301	301	14	4.7	20
	µg/l	TN3		-0.58	138	10	134	140	140	5	3.6	15
	mg/l	V2M		0.07	0.20	15	0.20	0.20	0.20	0.01	4.9	14
Ni	mg/l	A1M		-0.51	47.5	10	46.3	47.0	47.1	2.4	5.1	19
	mg/kg	LN4		-0.69	21.6	20	20.1	21.6	21.6	1.7	7.9	8
	µg/l	TN3		0.13	106	15	107	105	106	10	9.7	18
	µg/l	V2M		0.64	9.64	15	10.10	9.67	9.61	0.51	5.3	14
P_{tot}	g/kg	L4M		-0.18	36.2	15	35.7	35.7	36.2	1.8	5.1	10
S_{tot}	mg/l	TN3		0.83	168	10	175	170	168	5	3.1	9
	mg/l	V2M		0.57	31.7	10	32.6	31.8	31.6	1.2	3.9	13
Zn	mg/l	A1M		0.71	281	10	291	279	282	18	6.4	19
	mg/kg	LN4		0.00	593	15	593	593	599	33	5.6	9
	µg/l	TN3		0.11	119	15	120	120	119	6	4.8	18
	µg/l	V2M		0.18	52.0	15	52.7	52.4	52.0	2.4	4.7	14

APPENDIX 8: Summary of the z scores

Measurand	Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	%
Al	A1M	S	S	S	.	S	.	.	S	.	.	S	S	S	S	S	S	S	u	.	S	u	S	S	.	S	S	S	90.0
	LN4	.	S	.	.	.	.	.	.	.	.	S	.	.	S	.	.	.	S	.	S	q	S	.	.	.	.	.	85.7
	LO4	u	.	.	.	.	.	.	S	.	.	.	U	.	.	S	S	S	.	.	S	.	.	S	.	.	.	.	75.0
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	.	U	S	.	S	.	Q	S	.	S	U	S	S	.	S	.	S	S	.	.	.	S	S	S	83.3
	TY3	.	.	.	.	.	.	S	.	.	S	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	q	.	.	.	.	.	S	.	U	U	Q	S	U	S	S	S	S	.	S	S	S	S	.	.	S	S	72.2
As	A1M	.	S	S	.	q	.	.	S	.	.	S	S	S	.	S	S	S	S	.	S	S	S	U	.	S	S	.	88.2
	LN4	.	S	.	.	.	.	.	.	.	.	S	.	S	.	.	.	.	S	.	S	S	S	.	.	.	.	.	100
	LO4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	.	S	Q	.	S	.	S	S	.	S	.	S	S	.	S	.	S	S	.	.	.	.	S	.	93.3
	TY3	.	.	.	.	.	.	.	.	.	.	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	S	.	.	.	.	.	S	.	S	S	.	S	.	S	S	S	S	.	S	S	S	S	.	.	.	.	100
B	LN4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	LO4	.	.	.	.	.	.	.	S	.	.	.	S	.	.	S	S	S	.	.	.	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	.	.	.	.	.	S	.	.	S	.	S	S	S	S	.	S	.	S	S	.	.	.	.	S	.	100
	TY3	.	.	.	.	.	.	.	.	.	.	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	S	.	.	.	.	.	S	.	.	q	S	S	S	S	S	S	S	.	S	S	.	S	.	.	q	.	86.7
Ba	LN4	.	S	.	.	.	.	.	.	.	.	S	.	S	.	.	.	.	S	.	.	S	S	.	.	.	.	.	100
	LO4	S	.	.	.	.	.	.	S	.	.	.	S	.	.	S	S	S	.	.	S	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	q	.	.	.	.	.	S	.	.	S	.	S	.	S	S	.	S	.	S	S	.	.	.	.	.	.	90.0
	TY3	.	.	.	.	.	.	.	.	.	.	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	S	.	.	.	.	.	S	.	.	S	S	S	.	S	S	S	S	.	S	S	S	S	.	.	.	.	100
Ca	LN4	.	S	.	.	.	.	.	.	.	.	u	.	.	S	.	.	.	S	.	S	S	S	.	.	.	.	.	85.7
	LO4	S	.	.	.	.	.	.	S	.	.	.	S	.	.	S	S	S	.	.	S	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	.	u	.	S	.	S	.	U	u	.	.	S	S	S	.	S	.	S	S	.	.	.	S	S	S	81.3
	TY3	.	.	.	.	.	.	.	.	.	Q	.	S	.	.	S	.	S	.	.	S	.	S	S	.	.	.	.	85.7
	V2M	S	S	.	.	.	.	.	S	.	S	u	S	.	S	S	S	S	S	.	S	S	S	S	.	.	S	S	94.1
Cd	A1M	S	S	S	.	S	.	.	S	.	S	S	S	S	.	S	S	S	S	.	S	S	S	U	.	S	S	.	94.7
	LN4	.	q	.	.	.	.	.	.	.	.	S	.	S	.	.	.	.	S	.	S	S	S	.	.	.	.	.	85.7
	LO4	Q	.	.	.	.	.	.	S	.	S	.	S	.	.	.	S	Q	.	.	S	.	.	S	.	.	.	.	75.0
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	.	S	S	.	S	.	S	S	.	S	.	S	S	.	S	.	S	S	.	.	.	S	S	.	100
	TY3	.	.	.	.	.	.	.	.	.	.	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	S	.	.	.	.	.	S	.	S	S	S	S	.	S	S	S	S	.	S	S	S	S	.	.	S	.	100
Co	A1M	S	S	S	.	S	.	.	S	.	.	S	S	S	.	S	S	Q	S	.	S	S	S	S	.	u	S	.	88.9
	LN4	.	S	.	.	.	.	.	.	.	.	S	.	S	.	.	.	.	S	.	S	S	S	.	.	.	.	.	100
	LO4	q	.	.	.	.	.	.	S	.	.	.	S	.	.	S	S	S	.	.	S	.	.	S	.	.	.	.	87.5
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	.	S	S	.	S	.	.	S	.	S	.	S	S	.	S	.	S	S	.	.	.	S	S	.	100
	TY3	.	.	.	.	.	.	u	.	.	.	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	87.5
	V2M	S	S	.	.	.	.	.	S	.	.	q	S	S	.	S	S	S	S	.	S	S	S	S	.	.	.	.	92.9

Measurand	Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	%
Cr	A1M	S	S	S	.	S	.	.	S	.	S	S	S	S	.	S	S	S	S	.	S	S	S	S	.	S	S	.	100
	LN4	.	S	.	.	.	.	.	.	.	.	S	.	S	.	.	.	.	S	.	S	S	S	.	.	.	.	S	100
	LO4	S	.	.	.	.	.	.	S	.	S	.	S	.	.	S	S	S	.	.	S	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	.	S	Q	.	S	.	S	S	.	S	.	S	S	.	S	S	S	S	.	.	.	S	S	.	94.1
	TY3	.	.	.	.	.	.	S	.	.	S	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	S	.	.	.	.	.	S	.	S	u	S	S	.	S	S	U	S	.	S	S	S	S	.	.	S	.	87.5
Cu	A1M	S	S	S	.	Q	.	.	S	.	.	S	S	S	S	S	S	u	S	.	S	S	S	U	.	.	S	S	84.2
	LN4	.	S	.	.	.	.	.	.	.	.	S	.	S	S	.	.	.	S	.	S	S	S	.	.	.	.	S	100
	LO4	S	.	.	.	.	.	.	S	.	S	.	S	.	.	S	S	S	.	.	S	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	.	S	S	.	S	.	S	S	.	S	U	S	S	.	S	.	S	S	.	.	.	S	S	S	94.4
	TY3	.	.	.	.	.	.	.	.	.	S	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	S	.	.	.	.	.	S	.	U	u	S	S	U	S	S	S	S	.	S	S	S	S	.	.	q	S	77.8
Drw	L4M	S	S	.	S	.	.	.	S	.	S	.	S	S	S	S	S	S	S	.	S	S	.	S	.	.	.	.	100
Fe	A1M	S	S	S	.	S	.	.	S	.	.	S	S	S	S	S	S	S	S	.	S	S	Q	U	.	S	S	S	90.0
	LN4	.	S	.	.	.	.	.	.	.	.	S	.	.	q	.	.	.	u	.	U	S	Q	.	.	.	.	S	50.0
	LO4	S	.	.	.	.	.	.	S	.	.	.	S	.	.	S	S	S	S	.	S	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	S	S	S	.	S	.	S	U	.	S	U	S	S	.	S	S	S	S	.	.	.	S	S	S	90.0
	TY3	.	.	.	.	.	.	S	.	.	S	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	U	S	.	.	.	.	.	S	.	S	U	S	S	U	S	U	S	S	.	S	S	Q	S	.	.	S	S	72.2
Hg	A1Hg	S	.	S	.	S	.	.	S	.	S	U	u	S	.	S	S	U	S	.	S	S	U	S	.	.	.	.	75.0
	LC4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	LN4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	LO4	U	.	.	S	.	.	.	S	.	S	.	S	.	.	U	S	S	.	.	.	.	.	U	.	.	.	.	66.7
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	T3Hg	S	S	S	S	S	.	.	S	.	S	U	S	S	.	S	S	S	S	.	S	S	S	S	.	.	.	.	94.4
	V2Hg	S	S	.	.	S	.	.	S	.	S	U	S	S	.	S	S	U	S	.	S	S	S	S	.	.	.	.	87.5
Mg	LN4	.	S	.	.	.	.	.	.	.	.	S	.	.	S	.	.	.	S	.	S	S	S	.	.	.	.	.	100
	LO4	S	.	.	.	.	.	.	S	.	.	.	S	.	.	S	S	S	.	.	S	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	.	u	.	S	.	S	.	S	S	.	.	S	S	S	.	S	.	S	S	.	.	.	.	S	S	93.3
	TY3	.	.	.	.	.	.	S	.	.	.	.	S	.	.	S	.	S	.	.	u	.	S	S	.	.	.	.	85.7
	V2M	S	S	.	.	.	.	.	S	.	S	S	S	.	S	S	S	S	S	.	S	S	S	Q	.	.	S	S	94.1
Mn	A1M	S	S	S	.	S	.	.	S	.	.	S	S	S	S	S	S	S	S	.	S	S	S	S	.	S	S	S	100
	LN4	.	S	.	.	.	.	.	.	.	.	S	.	S	S	.	.	.	S	.	S	S	S	.	.	.	.	.	100
	LO4	S	.	.	.	.	.	.	S	.	.	.	S	.	.	S	S	S	.	.	S	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	q	S	.	q	S	.	S	.	u	S	.	S	U	S	S	.	S	.	S	S	.	.	.	.	S	S	76.5
	TY3	.	.	.	.	.	.	.	.	.	S	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	U	S	.	.	.	.	.	S	.	q	S	S	S	U	S	S	S	S	.	S	U	S	S	.	.	S	S	77.8
Mo	LN4	.	S	.	.	.	.	.	.	.	.	S	.	S	q	.	.	.	S	.	S	S	S	.	.	.	.	.	87.5
	LO4	S	.	.	.	.	.	.	S	.	.	.	S	.	.	S	S	S	S	.	S	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	.	.	.	.	S	.	.	S	.	S	S	S	S	.	S	U	S	S	.	.	.	S	.	.	92.9
	TY3	.	.	.	.	.	.	.	.	.	.	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	Q	S	.	.	.	.	.	S	.	.	S	S	S	S	S	S	S	S	.	S	S	S	S	.	.	.	.	93.3

Measurand	Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	%
Ni	A1M	S	S	S	.	S	.	.	S	.	S	S	S	S	.	S	S	S	S	.	S	S	S	U	.	S	S	S	95.0
	LN4	.	S	.	.	.	.	.	.	.	.	S	.	S	.	.	.	.	S	.	S	S	S	.	.	.	.	S	100
	LO4	Q	.	.	.	.	.	.	S	.	S	.	S	.	.	q	S	S	.	.	S	.	.	S	.	.	.	.	77.8
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	.	S	S	.	S	.	S	q	.	S	.	S	S	.	S	S	S	S	.	.	.	U	S	S	88.9
	TY3	.	.	.	.	.	.	.	.	.	.	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	S	.	.	.	.	.	S	.	S	u	S	S	.	S	S	S	S	.	S	S	.	S	.	.	.	S	93.3
N_{tot}	L4M	S	S	.	.	.	.	.	.	.	S	.	.	S	S	S	S	S	.	.	S	S	.	.	.	.	.	.	100
Pb	A1M	S	S	S	.	S	.	.	S	.	S	S	S	S	.	S	S	S	S	.	S	S	Q	U	.	S	S	.	89.5
	LN4	.	Q	.	.	.	.	.	.	.	.	S	.	S	.	.	.	.	Q	.	S	S	S	.	.	.	.	.	71.4
	LO4	S	.	.	.	.	.	.	S	.	S	.	S	.	.	S	S	U	.	.	S	.	.	S	.	.	.	.	88.9
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	q	S	S	.	q	S	.	S	.	Q	S	.	S	.	S	S	.	S	.	S	S	.	.	.	.	u	.	73.3
	TY3	.	.	.	.	.	.	.	.	.	S	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	q	S	.	.	.	.	.	S	.	S	Q	.	S	.	S	S	S	S	.	S	S	S	S	.	.	.	.	85.7
P_{tot}	L4M	S	S	.	.	.	.	.	S	.	U	.	U	.	u	u	S	S	S	.	S	S	.	S	.	.	.	S	71.4
Sb	LN4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	LO4	S	.	.	.	.	.	.	S	.	.	.	Q	.	.	u	S	S	S	.	S	.	S	S	.	.	.	.	80.0
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	.	.	S	.	S	.	.	S	.	S	.	S	S	.	S	.	S	S	.	.	.	.	.	.	100
	TY3	.	.	.	.	.	.	.	.	.	.	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	u	.	.	.	.	.	S	.	.	S	.	S	.	S	S	S	S	.	S	S	S	S	.	.	.	.	92.3
Se	A1M	S	S	S	.	.	.	.	S	.	.	S	S	S	.	S	S	Q	S	.	S	q	S	S	.	.	.	.	86.7
	LN4	.	S	.	.	.	.	.	.	.	.	S	.	S	.	.	.	.	q	.	S	S	S	.	.	.	.	.	85.7
	LO4	S	.	.	.	.	.	.	S	.	.	.	S	.	.	q	S	S	.	.	S	.	.	S	.	.	.	.	87.5
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	S	S	.	.	S	.	S	.	.	S	.	S	.	q	S	.	S	.	S	S	.	.	.	.	.	.	91.7
	TY3	.	.	.	.	.	.	.	.	.	.	.	S	S	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	q	.	.	.	.	.	S	.	.	S	.	S	.	S	S	S	S	.	S	S	S	S	.	.	.	.	92.3
Sn	LN4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	LO4	.	.	.	.	.	.	.	S	.	.	.	S	.	.	S	S	U	S	.	.	.	S	S	.	.	.	.	87.5
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	.	S	.	.	.	.	.	S	.	.	S	.	.	.	.	S	.	S	.	S	S	.	.	.	.	.	.	100
	TY3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	V2M	.	u	.	.	.	.	.	S	.	.	S	.	.	.	.	S	u	S	.	S	S	.	S	.	.	.	.	77.8
Sr	LN4	.	S	.	.	.	.	.	.	.	.	S	.	.	.	.	.	.	S	.	S	S	S	.	.	.	.	.	100
	LO4	.	.	.	.	.	.	.	S	.	.	.	S	.	.	S	S	S	.	.	S	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	.	S	.	.	.	.	.	S	.	.	S	.	.	.	S	S	.	S	.	S	S	.	.	.	.	q	.	88.9
	TY3	.	.	.	.	.	.	.	.	.	.	.	S	.	.	S	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	.	S	.	.	.	.	.	S	.	.	S	S	.	.	S	S	S	S	.	S	S	S	S	.	.	u	.	92.3
S_{tot}	L4M	S	S	.	.	.	.	.	S	.	.	.	S	.	u	S	S	S	S	.	S	.	S	S	.	.	.	.	91.7
	TN3	S	S	.	.	.	.	.	S	.	.	.	.	.	S	S	S	.	S	.	U	u	.	.	.	.	S	S	81.8
	TY3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	V2M	S	S	.	.	.	.	.	S	.	.	.	S	.	S	S	S	S	S	.	U	u	S	S	.	.	S	S	86.7
V	A1M	S	S	.	.	S	.	.	S	.	.	S	S	S	.	S	S	S	S	.	S	S	S	S	.	.	.	.	100
	LN4	.	U	.	.	.	.	.	.	.	.	S	.	S	.	.	.	.	S	.	S	S	S	.	.	.	.	.	85.7
	LO4	S	.	.	.	.	.	.	S	.	.	.	S	.	.	u	S	S	.	.	S	.	.	S	.	.	.	.	87.5
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	

Measurand	Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	%
V	TN3	S	*S*	.	.	*S*	*S*	.	S	.	.	*S*	.	S	.	*S*	S	.	S	.	S	u	.	.	.	.	.	.	91.7
	TY3	.	.	.	.	.	.	.	.	.	.	.	S	S	.	*S*	.	S	.	.	S	.	S	S	.	.	.	.	100
	V2M	S	*S*	.	.	.	.	.	S	.	.	*S*	.	S	.	*S*	S	S	S	.	S	S	S	S	.	.	.	.	100
Zn	A1M	S	*S*	*S*	.	*S*	.	.	S	.	.	*S*	S	S	Q	S	S	S	S	.	S	S	S	U	.	*S*	*S*	S	90.0
	LN4	.	*S*	.	.	.	.	.	.	.	.	*S*	.	S	*S*	.	.	.	S	.	S	S	S	.	.	.	.	S	100
	LO4	*S*	.	.	.	.	.	.	S	.	*S*	.	S	.	.	S	S	S	.	.	S	.	.	S	.	.	.	.	100
	LT4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
	TN3	S	*S*	*S*	.	*S*	*S*	.	S	.	S	*Q*	.	S	*U*	*u*	S	.	S	S	S	S	.	.	.	*S*	*S*	S	84.2
	TY3	.	.	.	.	.	.	u	.	.	S	.	S	S	.	*q*	.	U	.	.	S	.	S	S	*S*	.	.	.	70.0
	V2M	S	*S*	.	.	.	.	.	S	.	S	*U*	S	S	*U*	*S*	S	S	S	.	S	S	.	U	.	.	*S*	S	82.4
%		87	89	100	67	81	88	67	100		82	76	94	100	59	91	99	87	95	80	97	91	93	88	100	90	87	100	
accredited		47			3			6	76		38		64	72	5	61	73	71	62	3	105	68	75	83				24	

S - satisfactory (-2 ≤ z ≤ 2), Q - questionable (2 < z < 3), q - questionable (-3 < z < -2),
U - unsatisfactory (z ≥ 3), and u - unsatisfactory (z ≤ -3), respectively
bold - accredited, italics - non-accredited, normal - other
% - percentage of satisfactory results

Totally satisfactory, % in all: 91 % in accredited: 94 % in non-accredited: 85

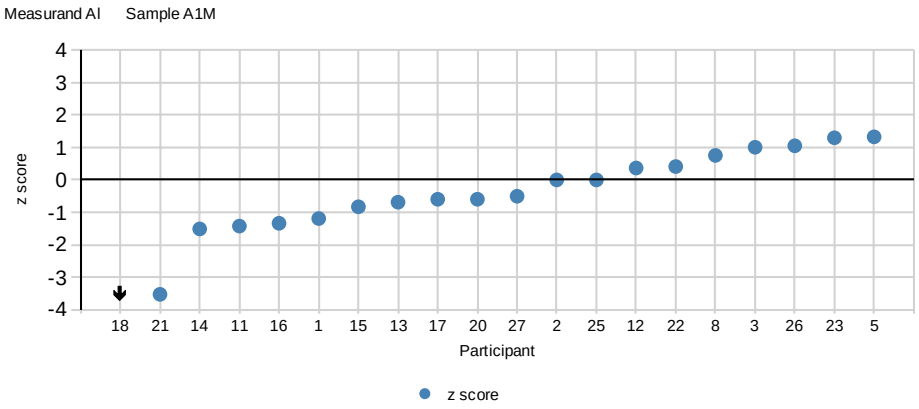
APPENDIX 9: Summary of the D% scores

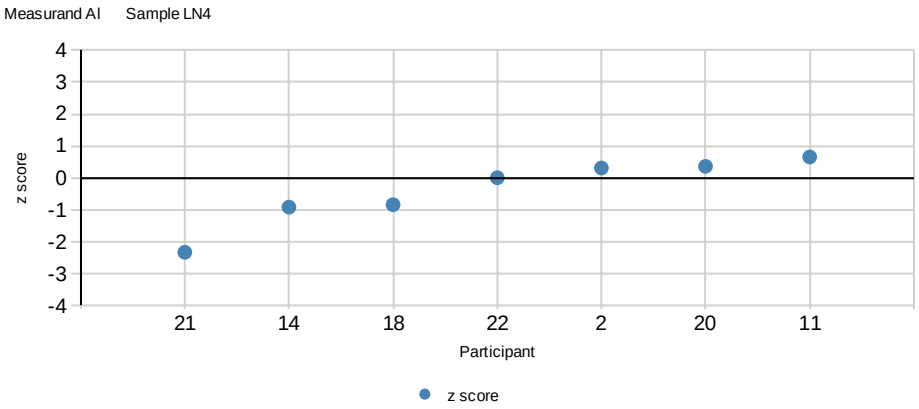
Measurand	Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
B	LN4	.	9.7	.	.	.	.	.	.	.	.	4.9	.	.	.	.	.	.	.	.	.	-14	.	.	.	.	.	.
Hg	LC4	.	.	.	.	.	.	.	.	-0.1	.	0.1		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	LN4	.	-70	.	.	.	.	.	.	.	.	-18	.	-2.7	.	.	.	.	.	.	.	14	3.7	.	.	.	.	.
Sb	LN4	.	14	.	.	.	.	.	.	.	.	-9.0	.	.	.	.	.	.	.	.	-3.1	3,0	.	.	.	.	.	.
Sn	TY3	.	.	.	.	.	.	.	.	.	.	.	-0.6	.	.	.	.	-6.4	.	.	12	.	.	0.7	.	.	.	.
S_{tot}	TY3	.	.	.	.	.	.	.	.	.	.	.	0	.	.	-16	.	-7.1	.	.	>100	.	14	1.8	.	.	.	.

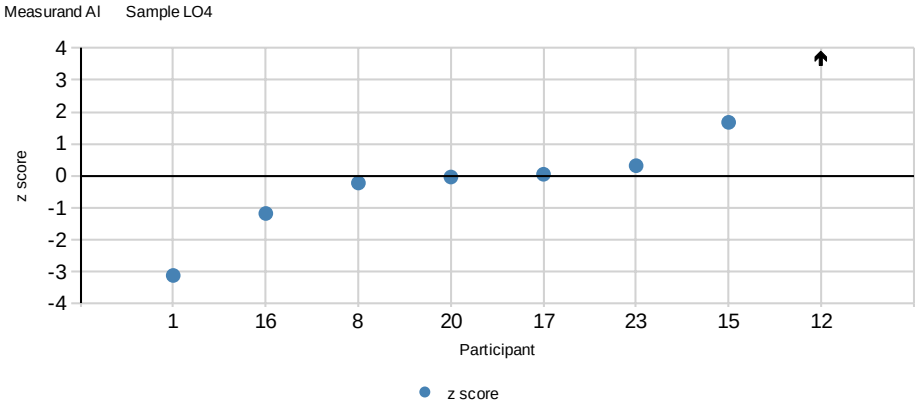
D can be interpreted as the measurement error for the result, to the extent to which the assigned value can be considered a reference quantity value.

Section break: Hidden. Don’t delete!

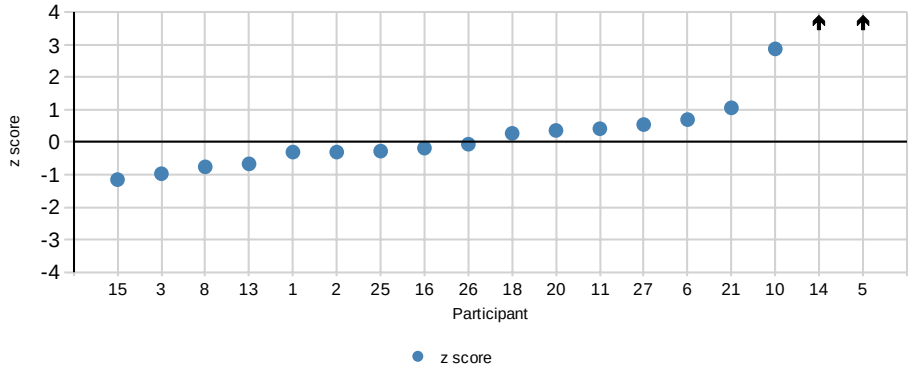
APPENDIX 10: z scores in ascending order



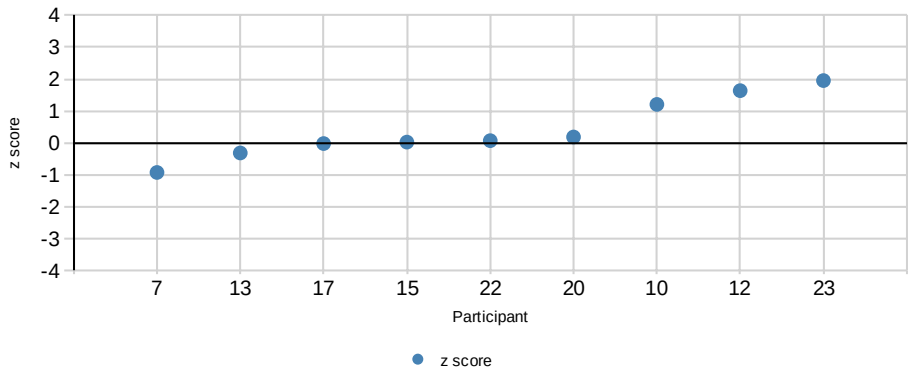




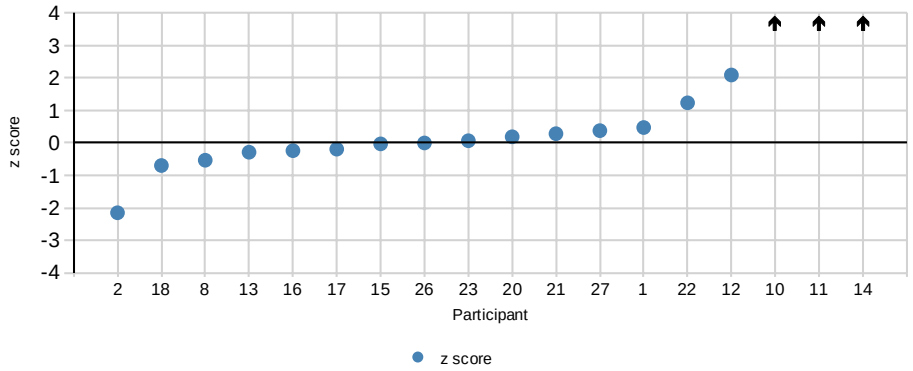
Measurand Al Sample TN3

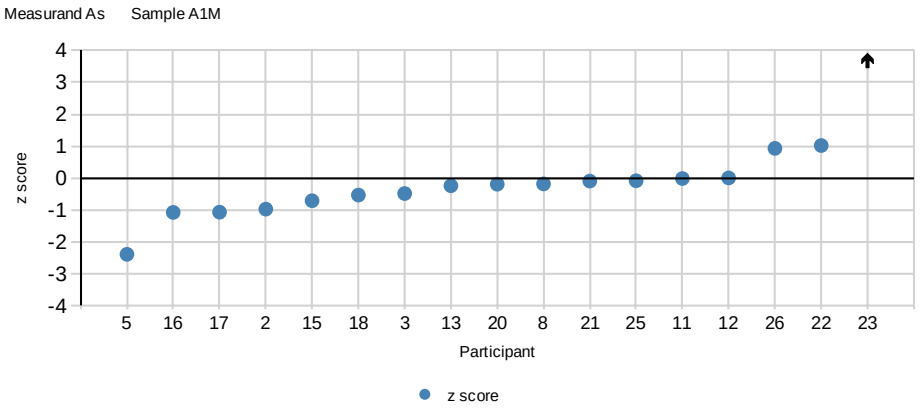


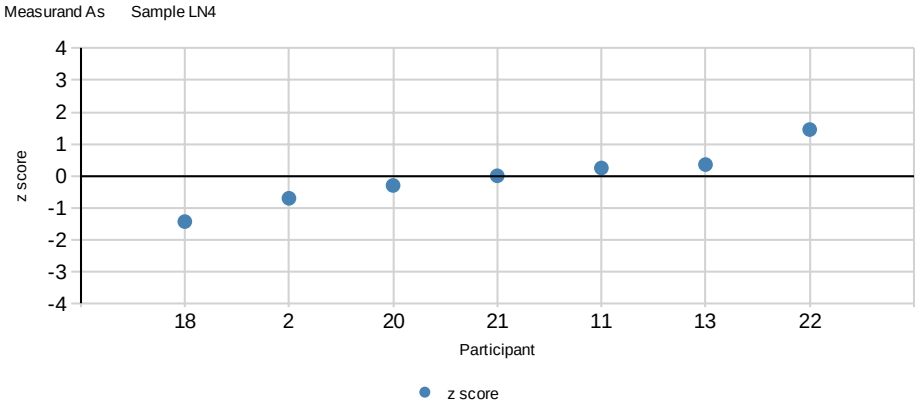
Measurand Al Sample TY3

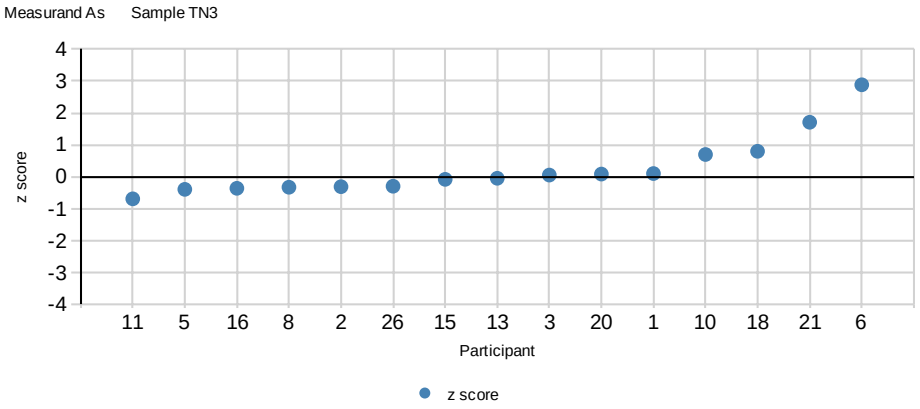


Measurand Al Sample V2M

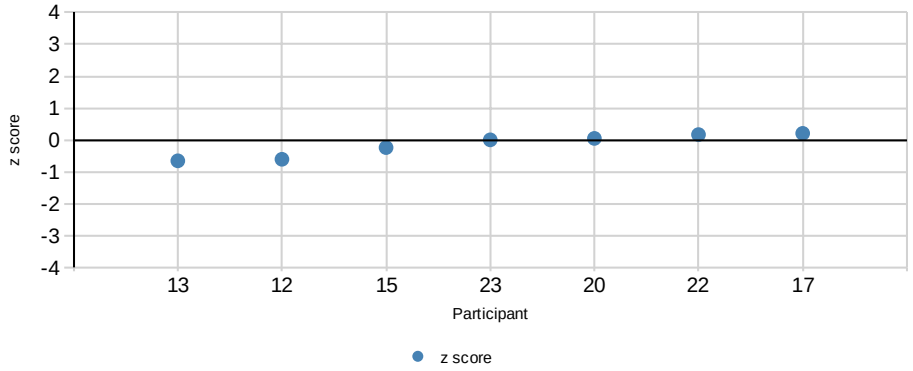



Measurand As Sample A1M
z score
4
3
2
1
0
-1
-2
-3
-4
5 16 17 2 15 18 3 13 20 8 21 25 11 12 26 22 23
Participant
z score

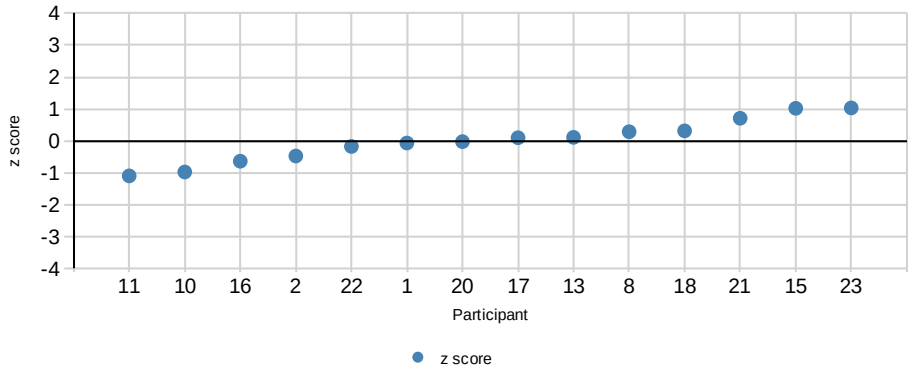

Measurand As Sample LN4
z score
4
3
2
1
0
-1
-2
-3
-4
18 2 20 21 11 13 22
Participant
z score


Measurand As Sample TN3
z score
4
3
2
1
0
-1
-2
-3
-4
11 5 16 8 2 26 15 13 3 20 1 10 18 21 6
Participant
z score

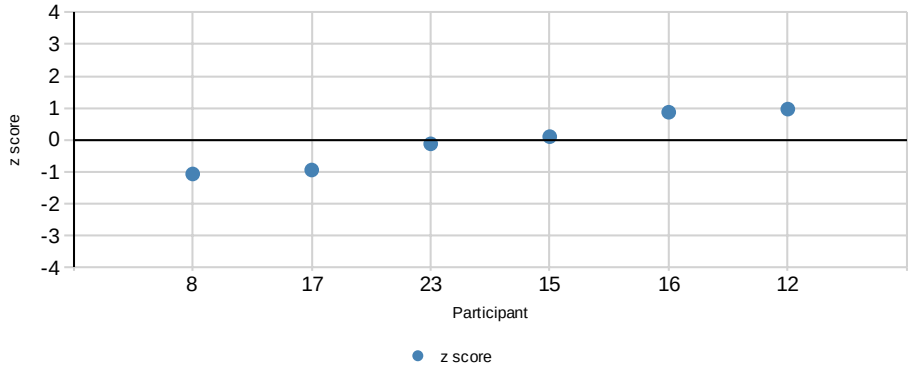
Measurand As Sample TY3

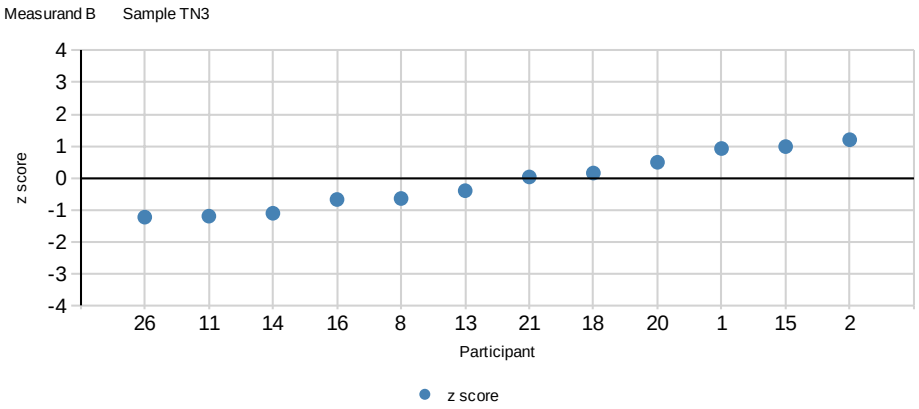


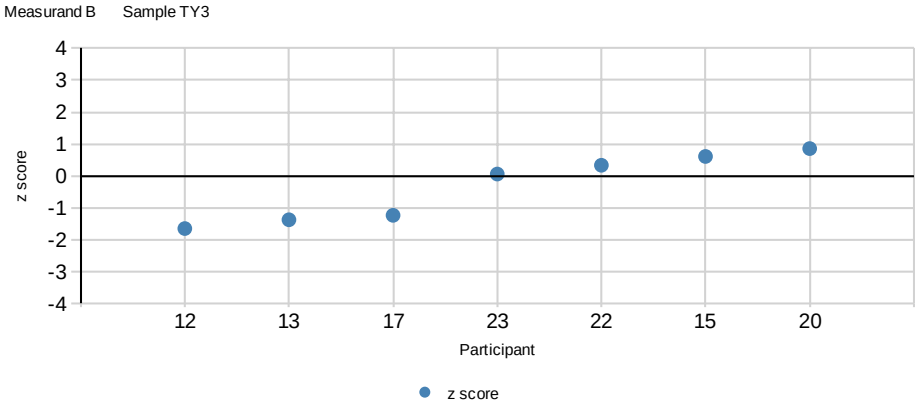
Measurand As Sample V2M

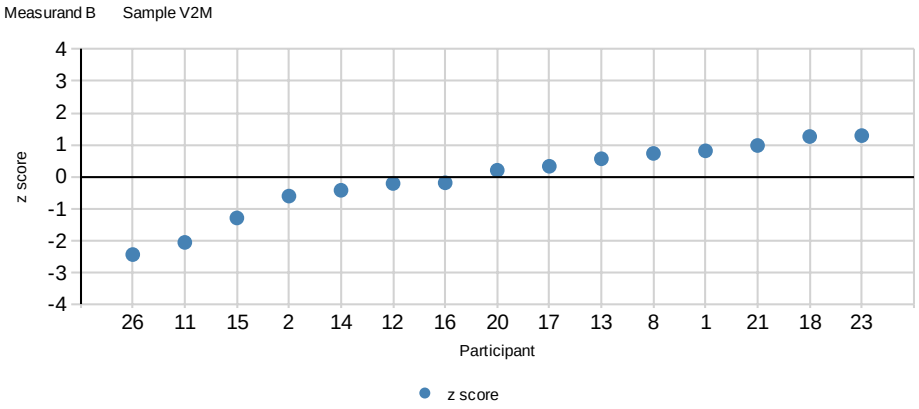


Measurand B Sample LO4

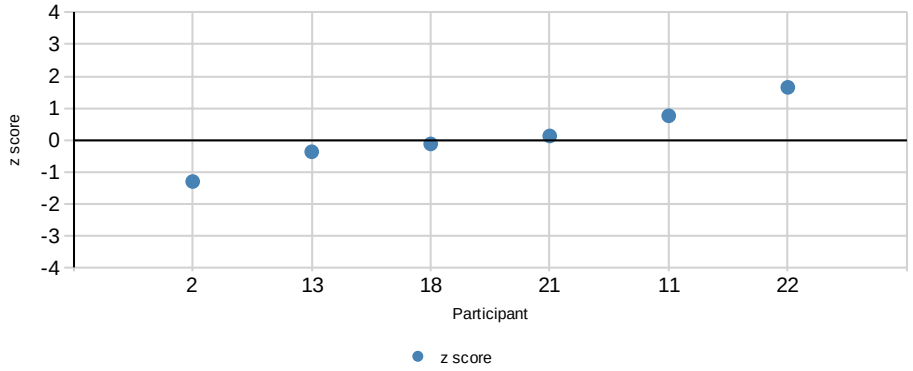



Measurand B Sample TN3
z score
4
3
2
1
0
-1
-2
-3
-4
26 11 14 16 8 13 21 18 20 1 15 2
Participant
z score

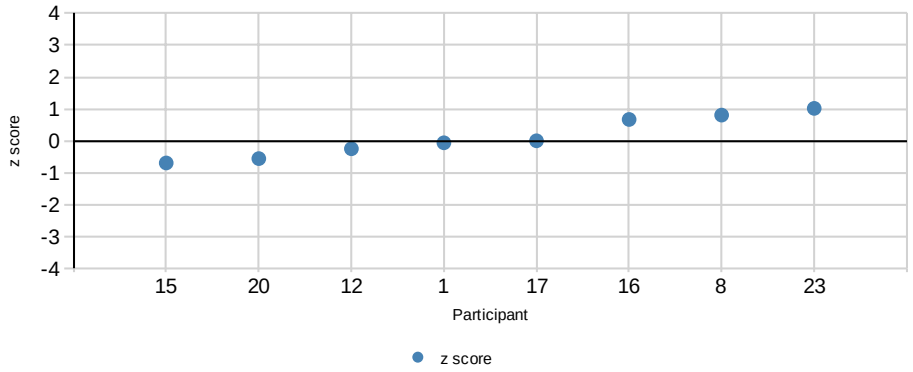

Measurand B Sample TY3
z score
4
3
2
1
0
-1
-2
-3
-4
12 13 17 23 22 15 20
Participant
z score


Measurand B Sample V2M
z score
4
3
2
1
0
-1
-2
-3
-4
26 11 15 2 14 12 16 20 17 13 8 1 21 18 23
Participant
z score

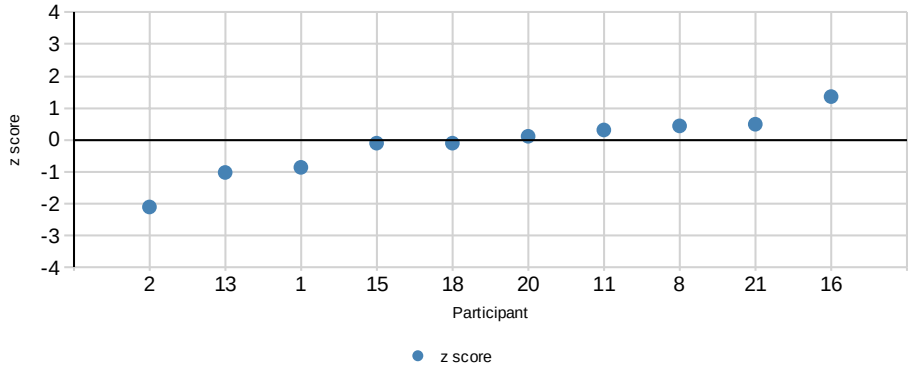
Measurand Ba Sample LN4



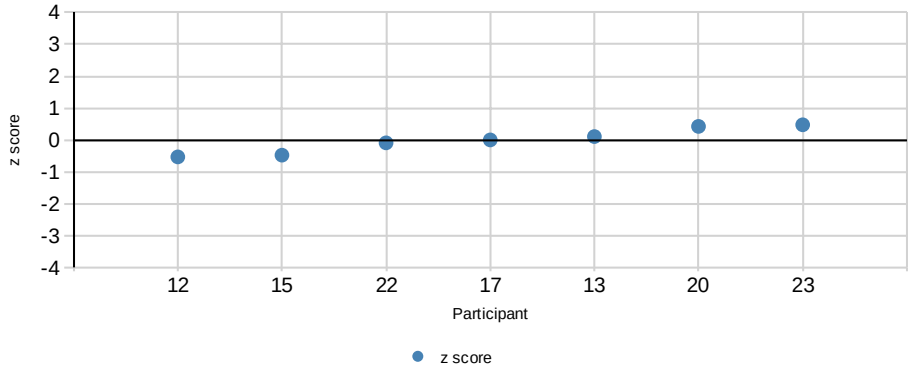
Measurand Ba Sample LO4



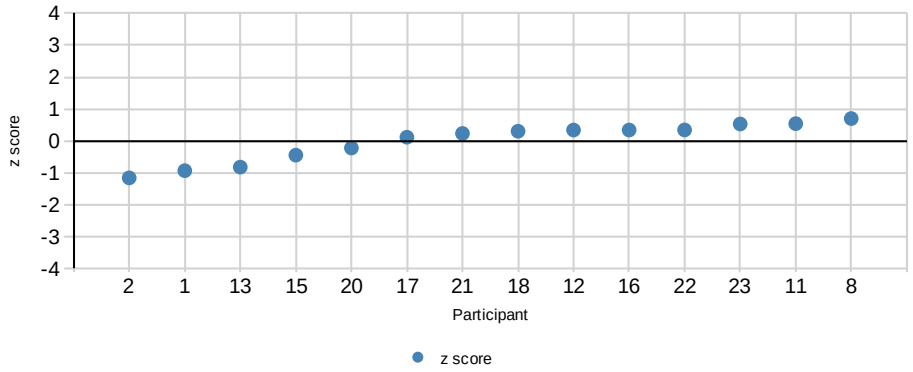
Measurand Ba Sample TN3



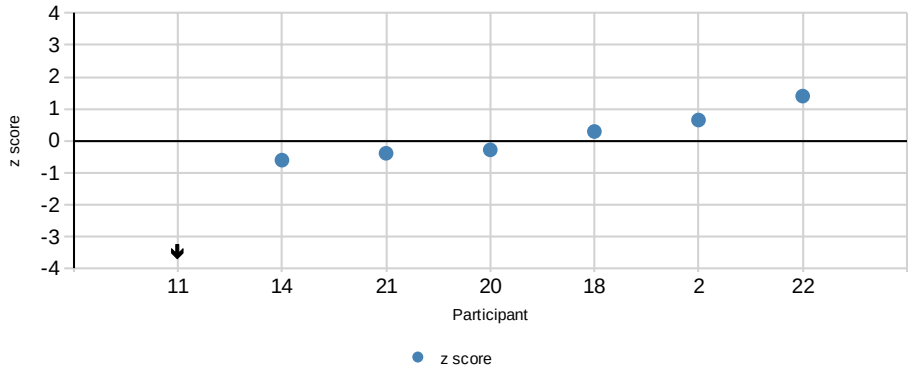
Measurand Ba Sample TY3



Measurand Ba Sample V2M



Measurand Ca Sample LN4



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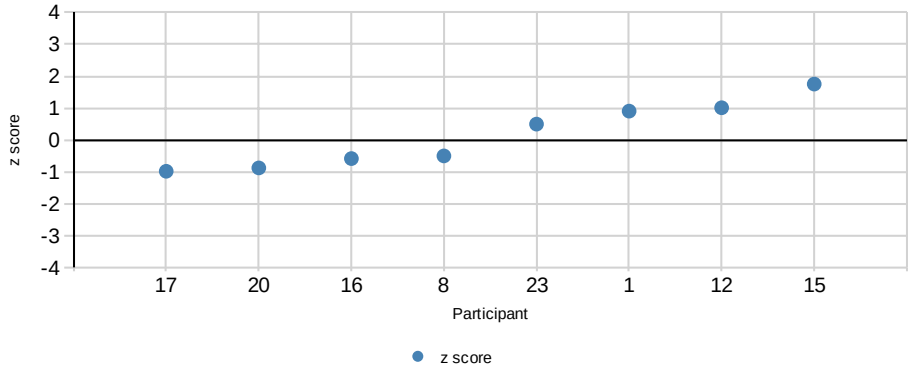

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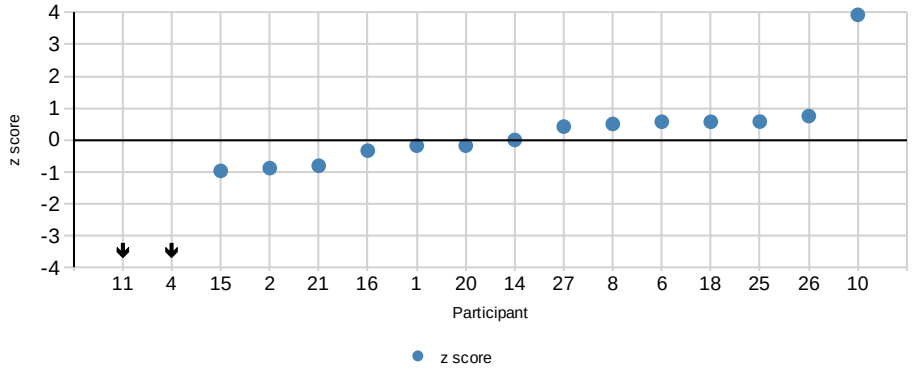

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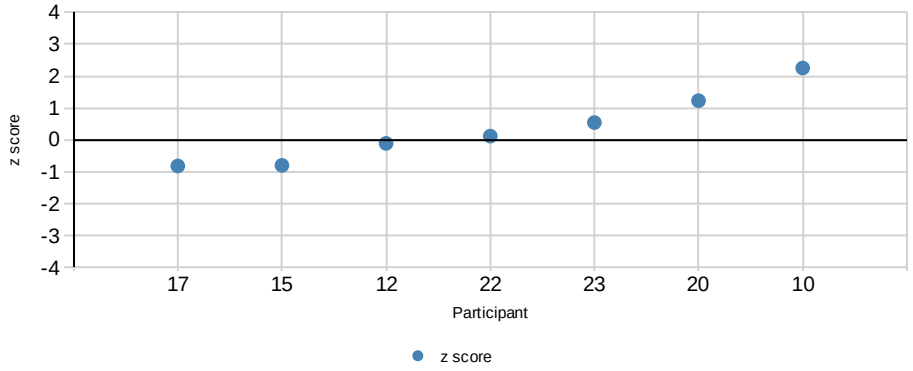
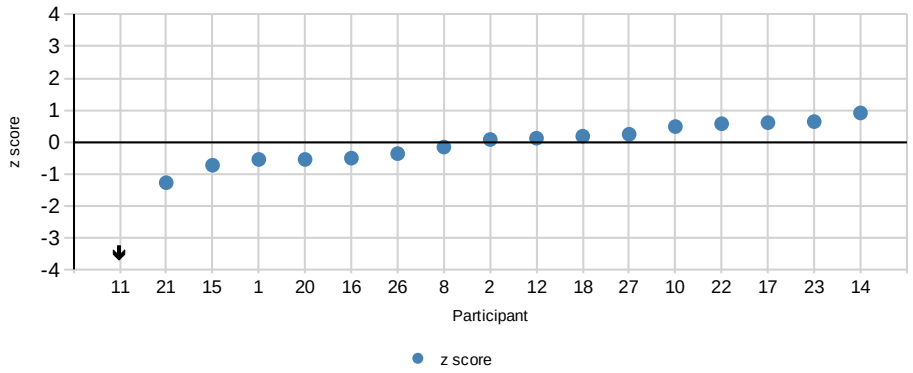
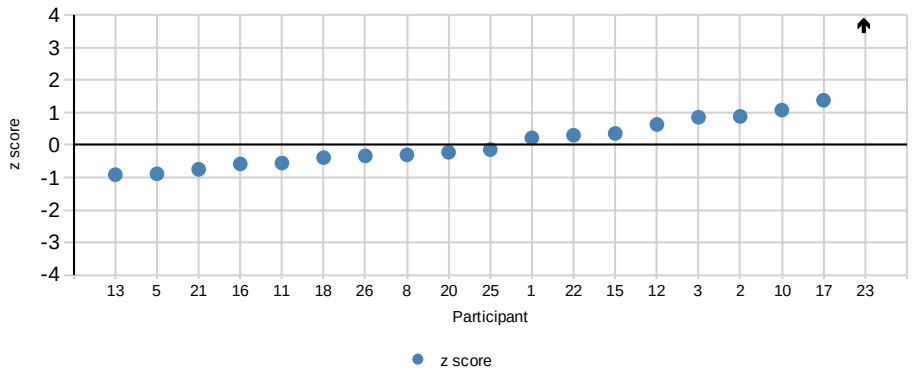


Measurand Ca Sample V2M



Measurand Cd Sample A1M



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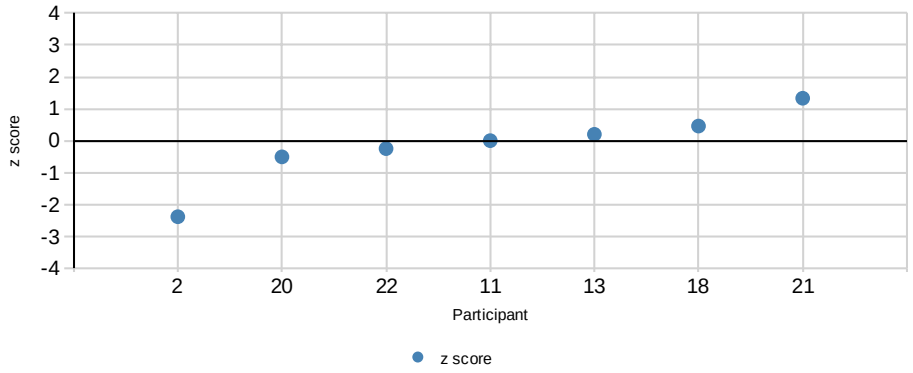

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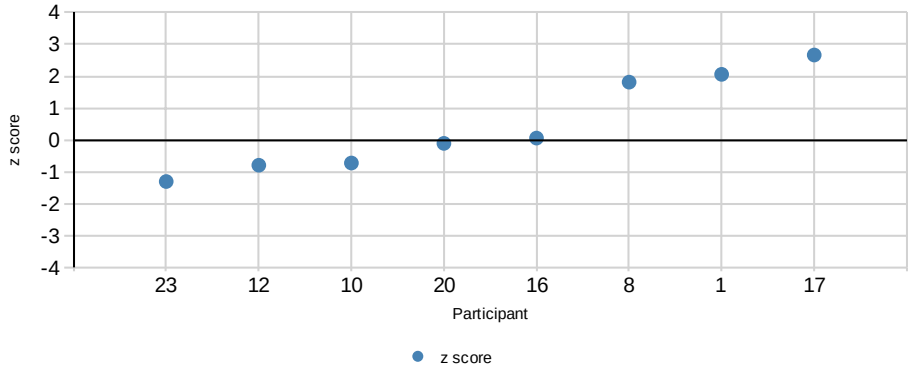
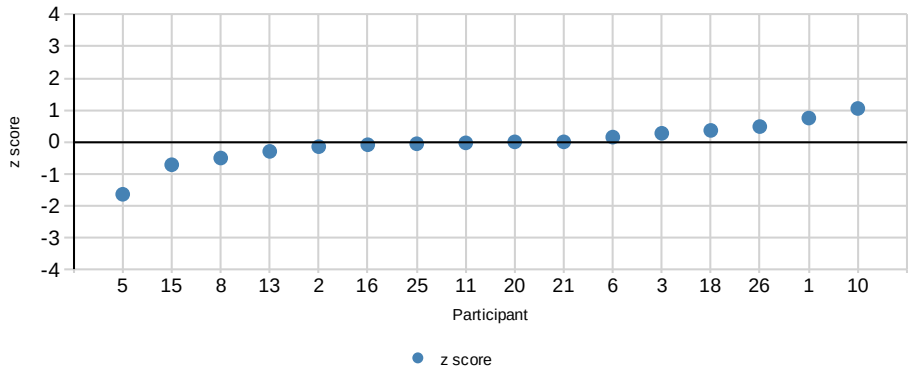
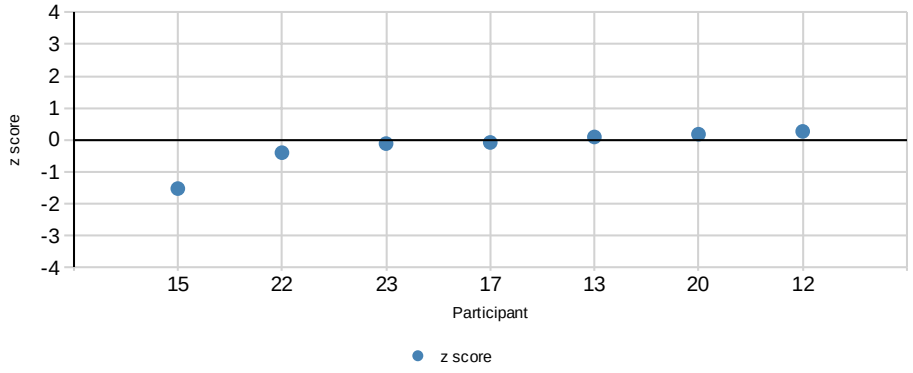
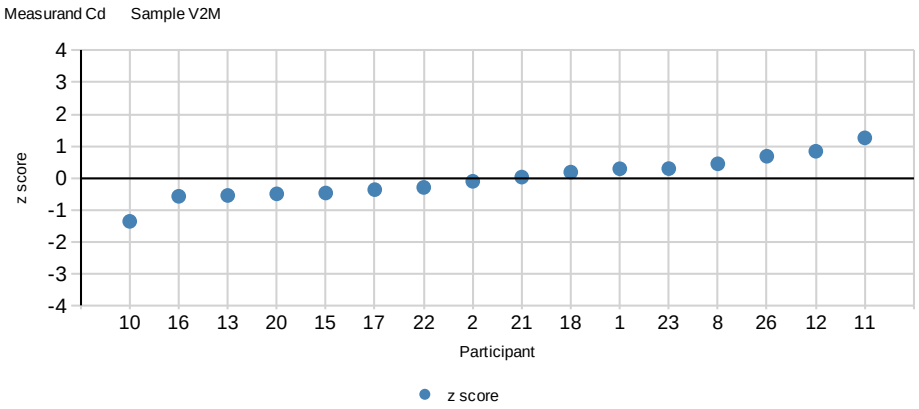


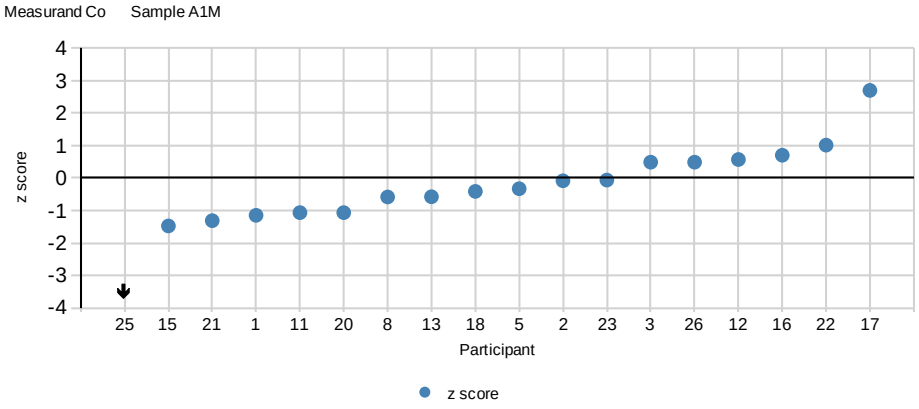
Measurand Cd Sample TN3

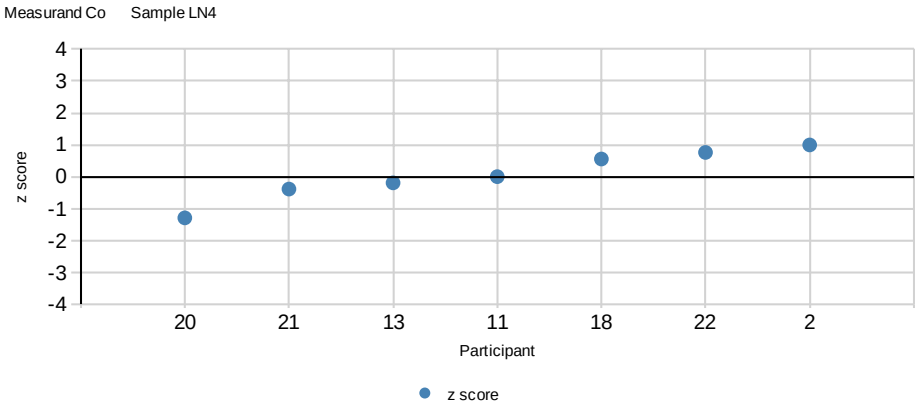


Measurand Cd Sample TY3

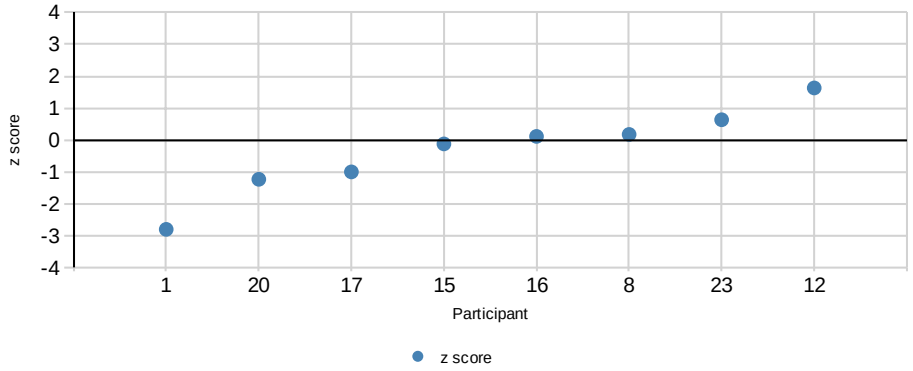



Measurand Cd Sample V2M
z score
4
3
2
1
0
-1
-2
-3
-4
10 16 13 20 15 17 22 2 21 18 1 23 8 26 12 11
Participant
z score

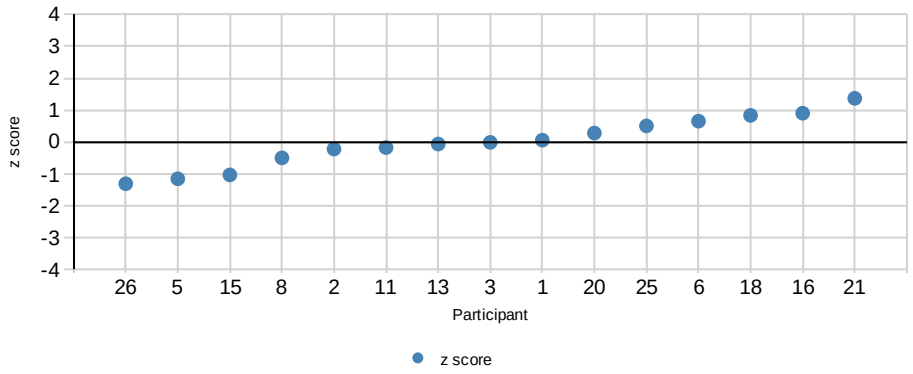

Measurand Co Sample A1M
z score
4
3
2
1
0
-1
-2
-3
-4
25 15 21 1 11 20 8 13 18 5 2 23 3 26 12 16 22 17
Participant
z score


Measurand Co Sample LN4
z score
4
3
2
1
0
-1
-2
-3
-4
20 21 13 11 18 22 2
Participant
z score

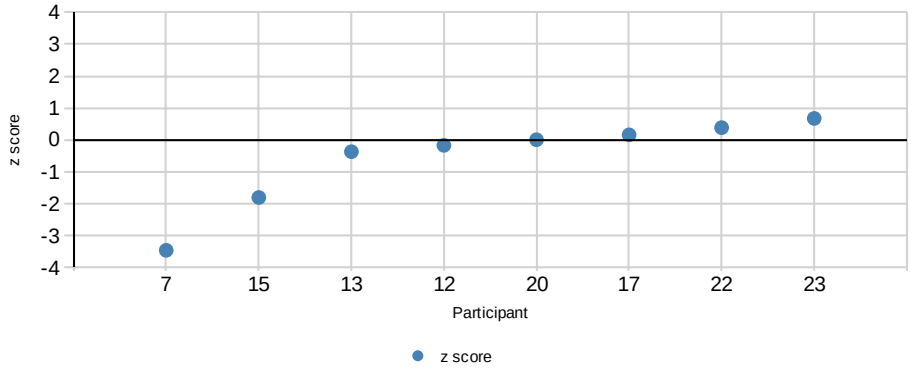
Measurand Co Sample LO4



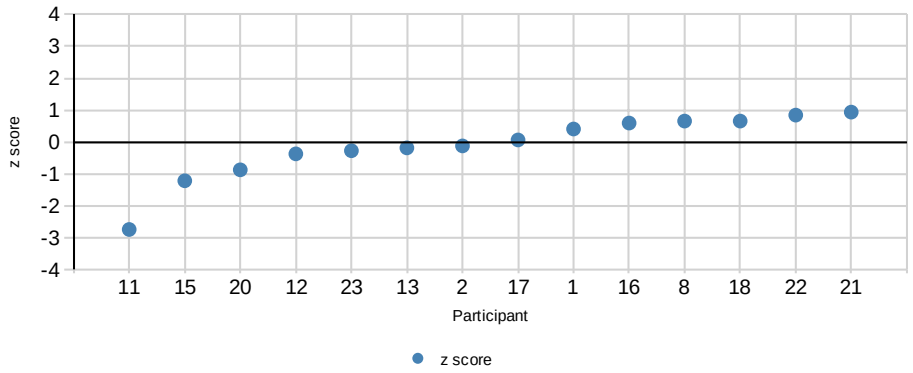
Measurand Co Sample TN3



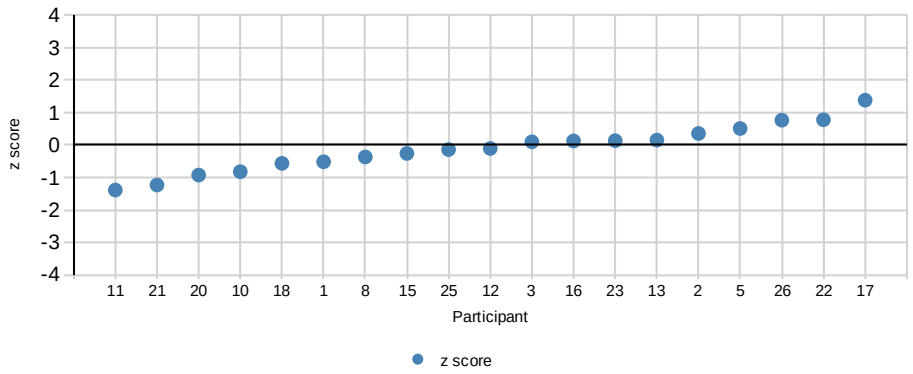
Measurand Co Sample TY3



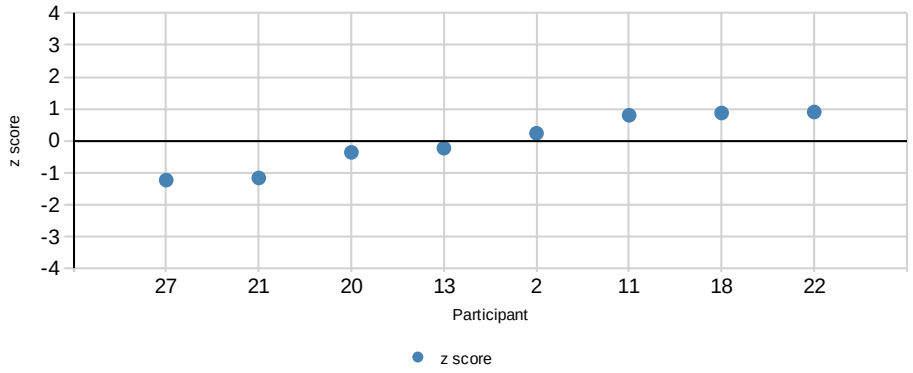
Measurand Co Sample V2M



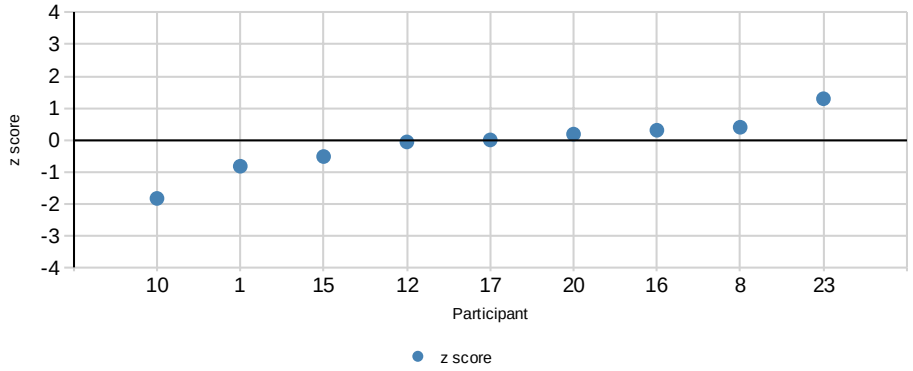
Measurand Cr Sample A1M



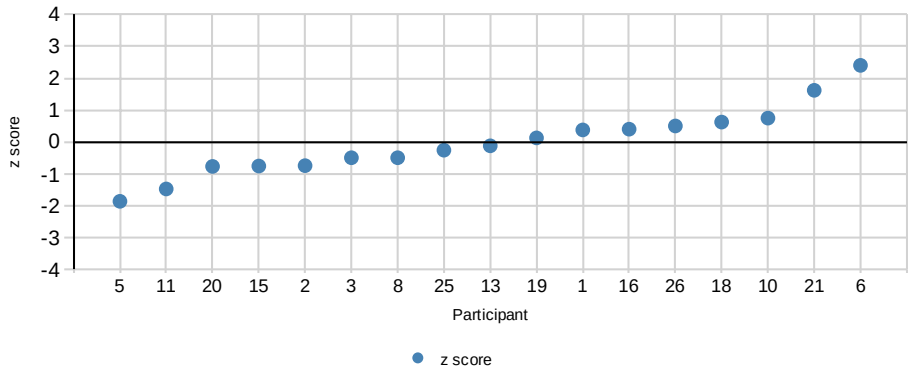
Measurand Cr Sample LN4



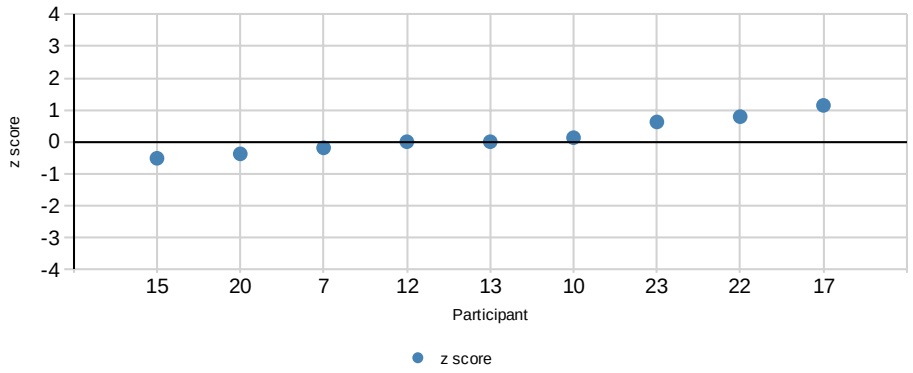
Measurand Cr Sample LO4



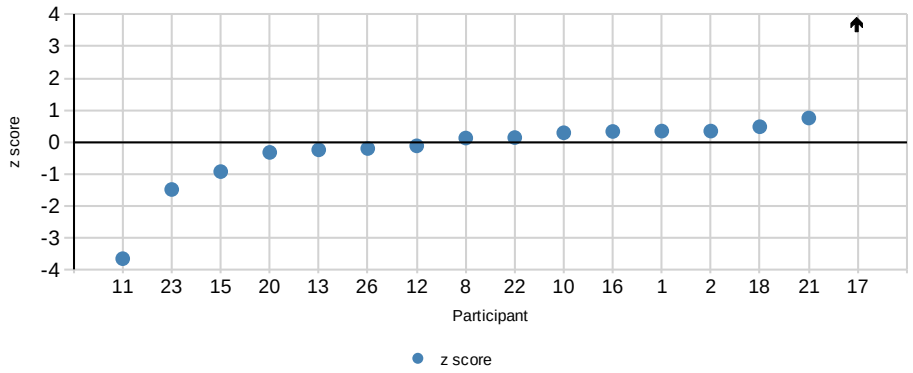
Measurand Cr Sample TN3



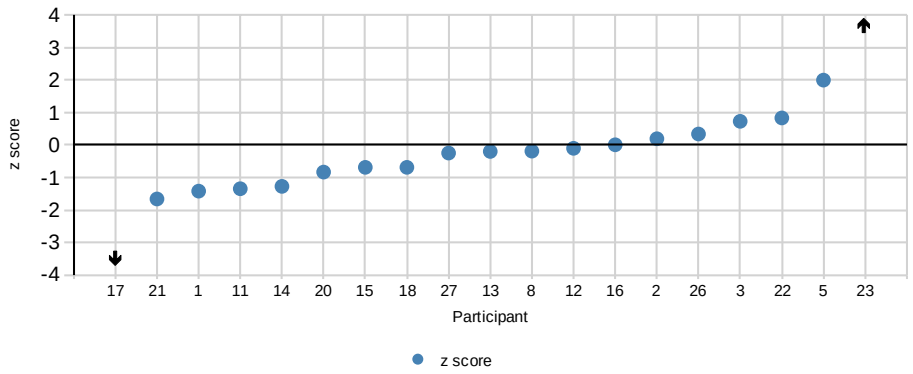
Measurand Cr Sample TY3



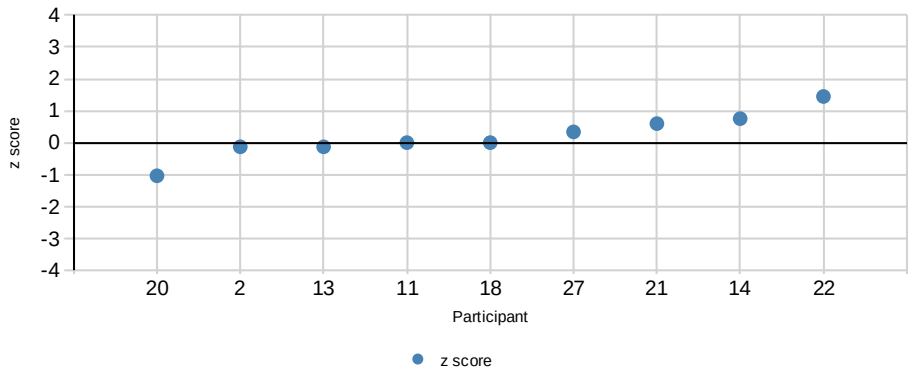
Measurand Cr Sample V2M



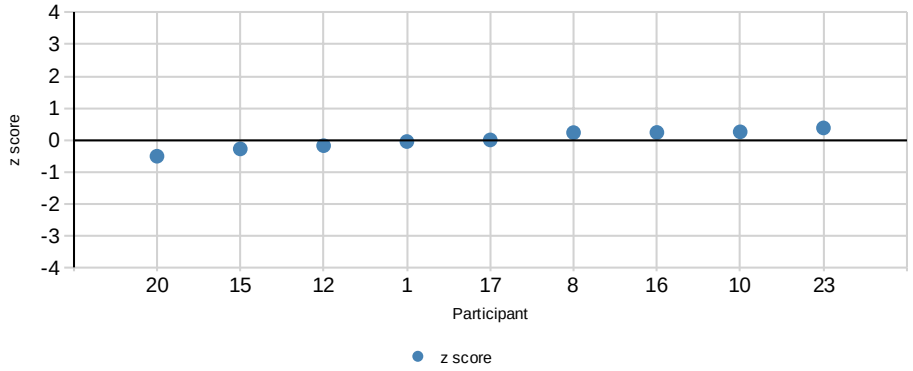
Measurand Cu Sample A1M



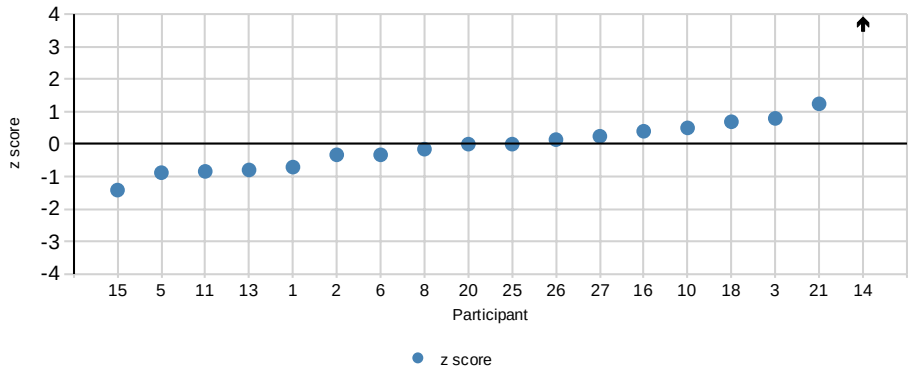
Measurand Cu Sample LN4



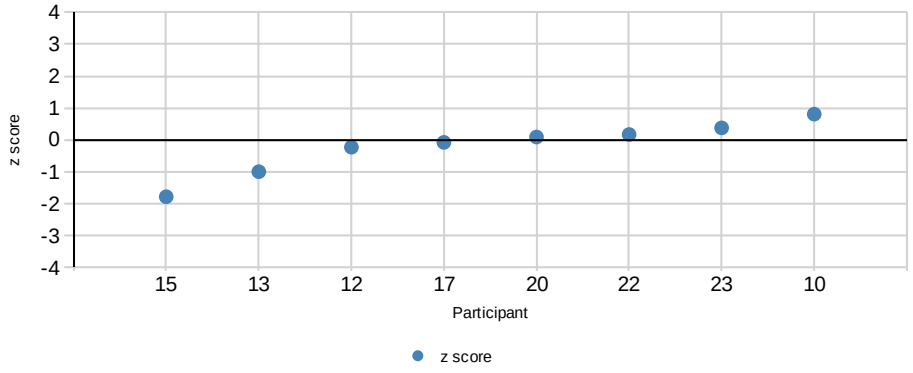
Measurand Cu Sample LO4



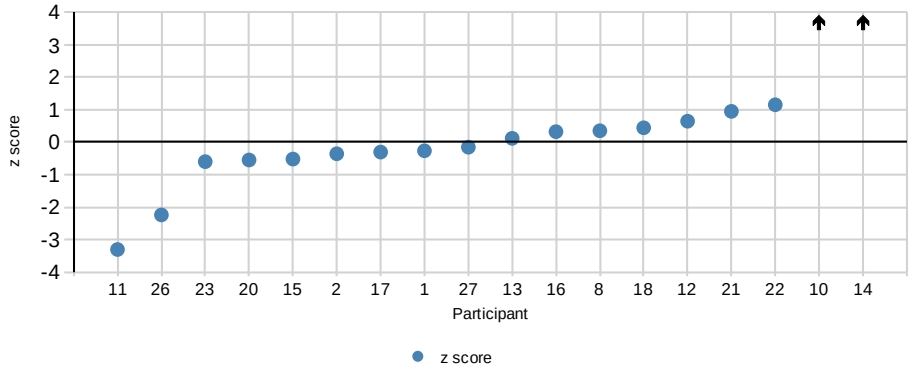
Measurand Cu Sample TN3



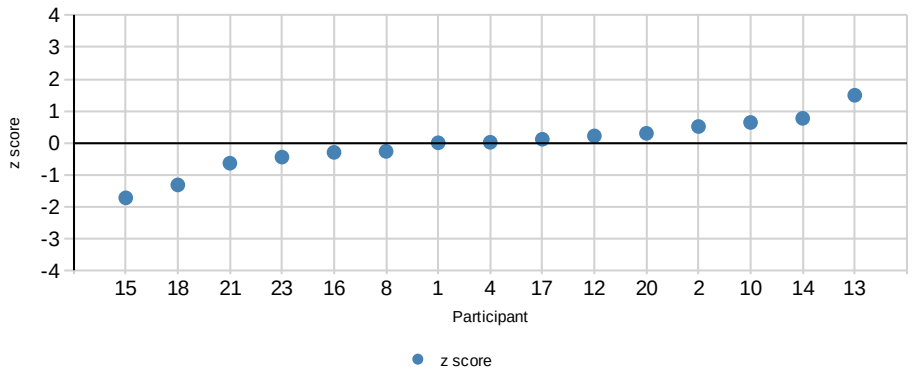
Measurand Cu Sample TY3



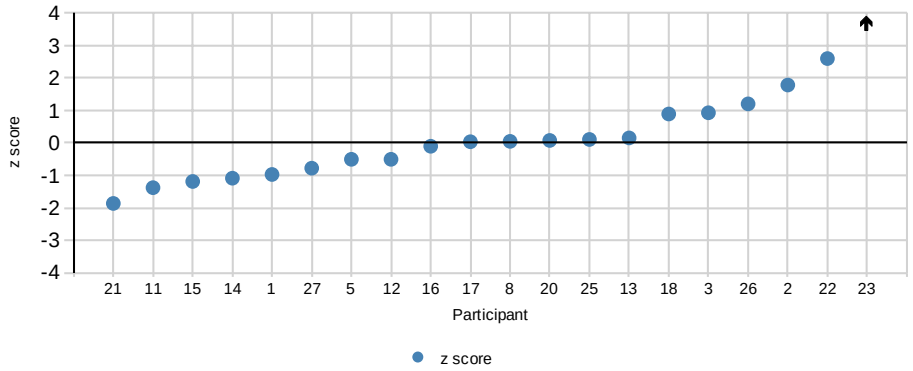
Measurand Cu Sample V2M



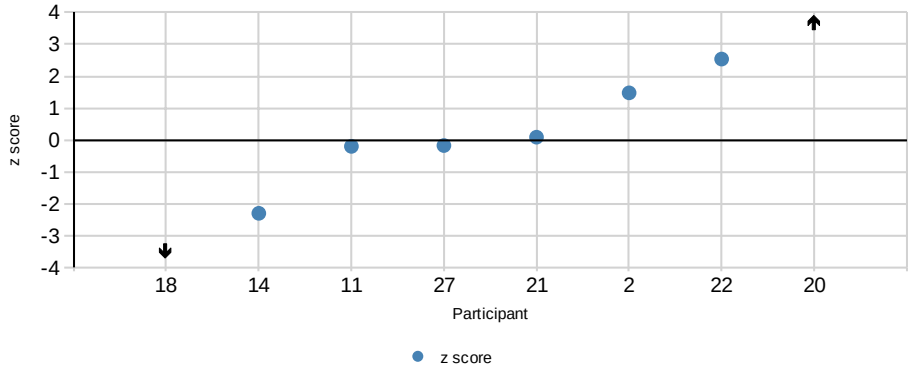
Measurand Drw Sample L4M



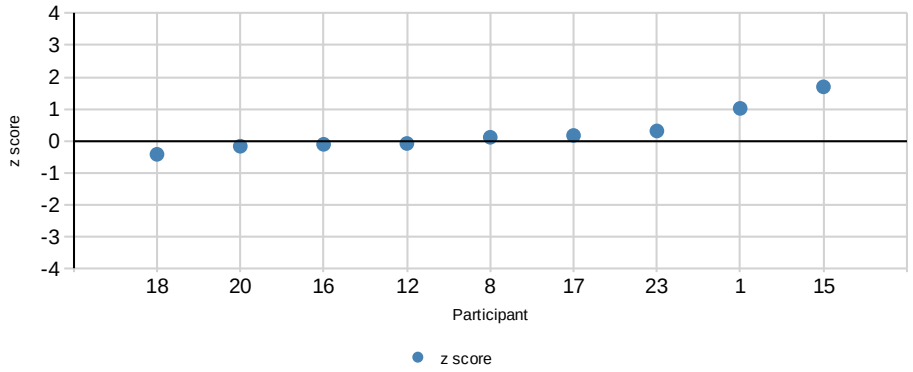
Measurand Fe Sample A1M



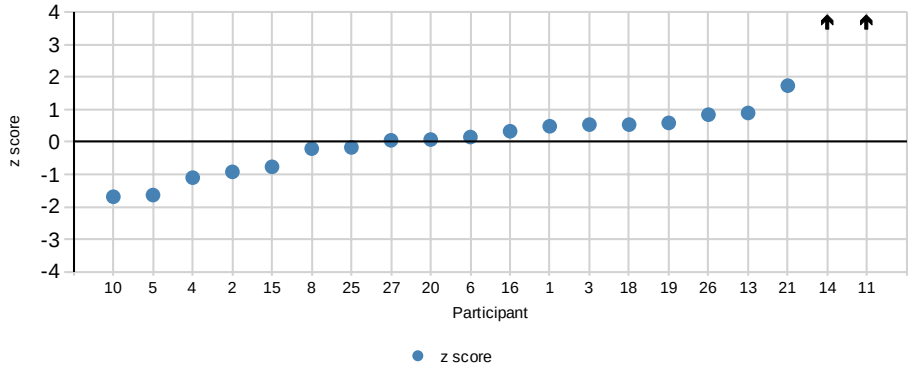
Measurand Fe Sample LN4



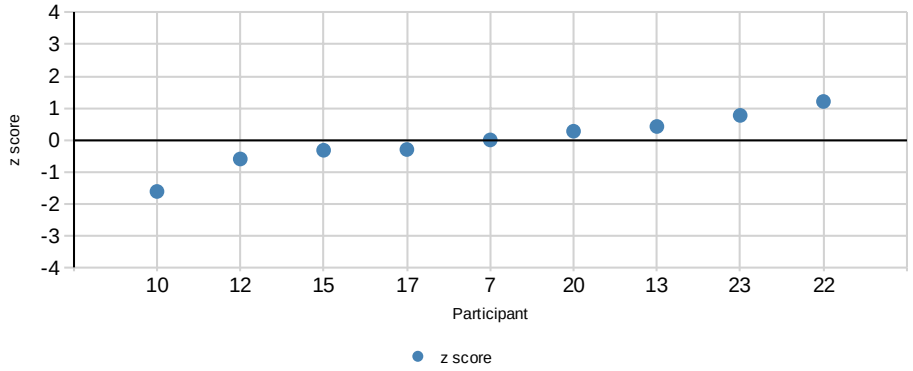
Measurand Fe Sample LO4



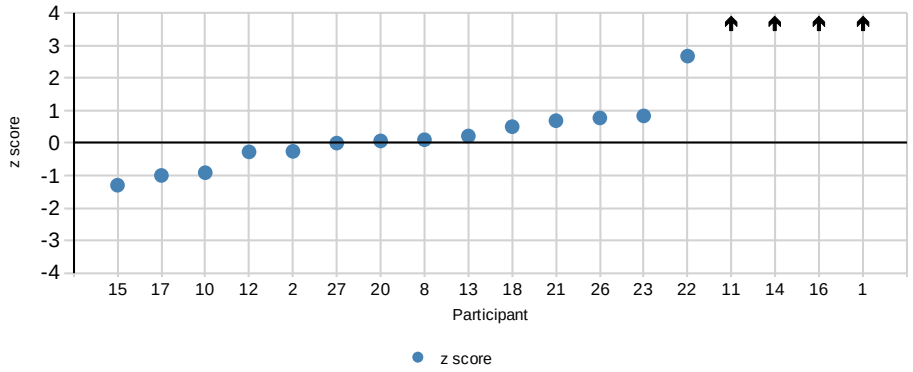
Measurand Fe Sample TN3



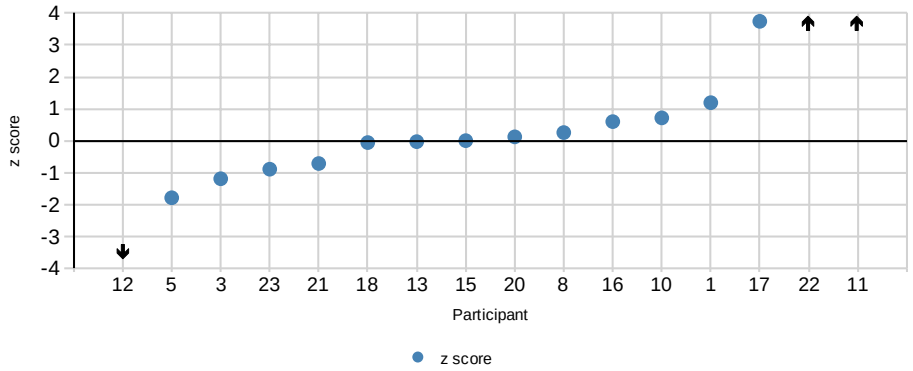
Measurand Fe Sample TY3



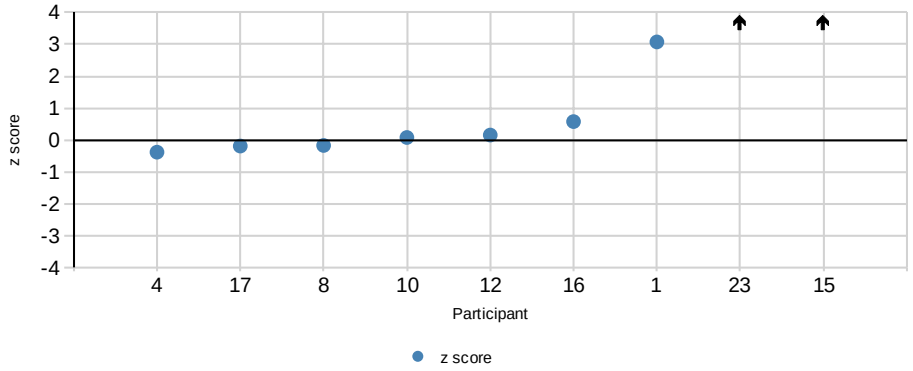
Measurand Fe Sample V2M



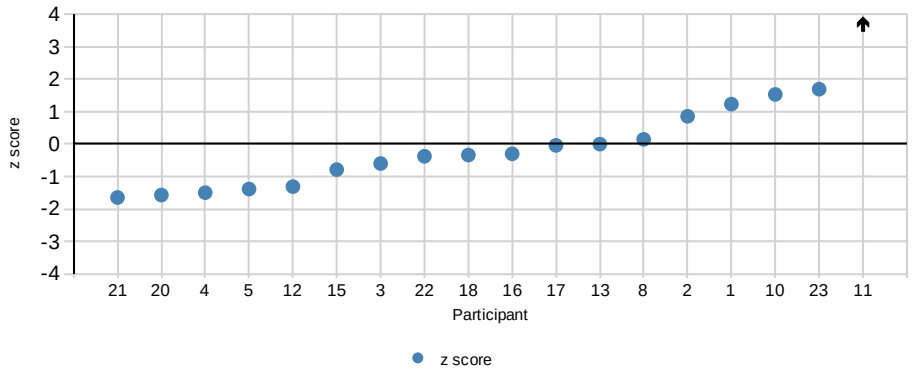
Measurand Hg Sample A1Hg



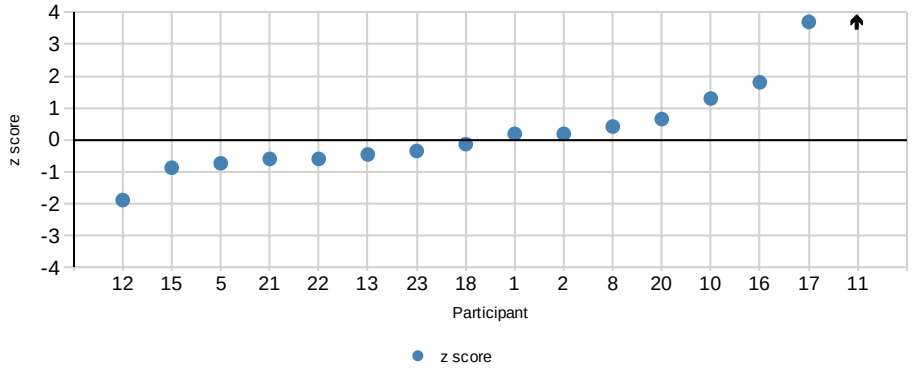
Measurand Hg Sample LO4

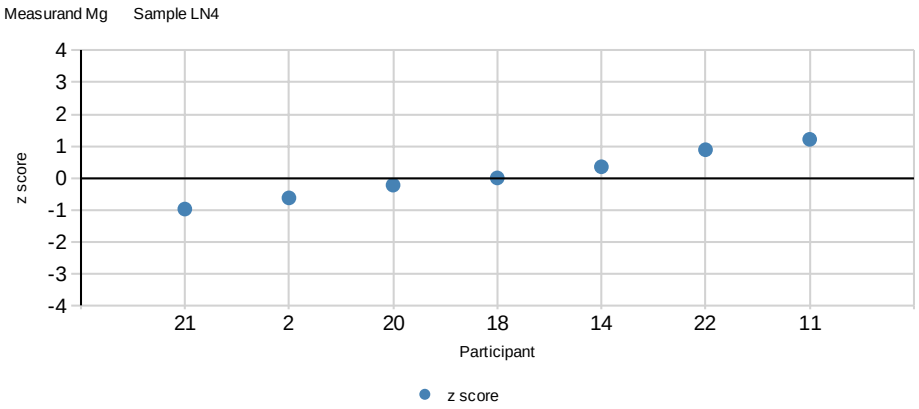


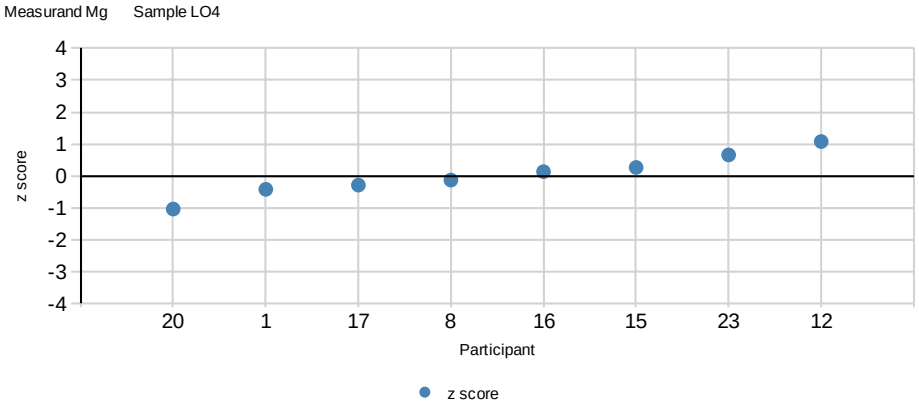
Measurand Hg Sample T3Hg

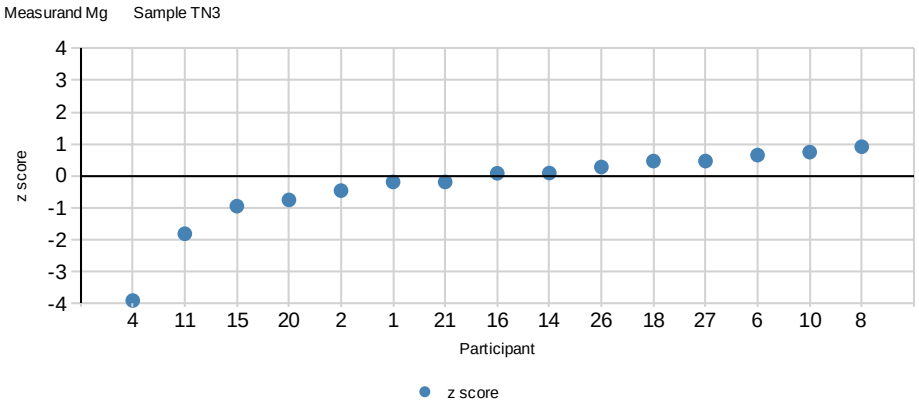


Measurand Hg Sample V2Hg

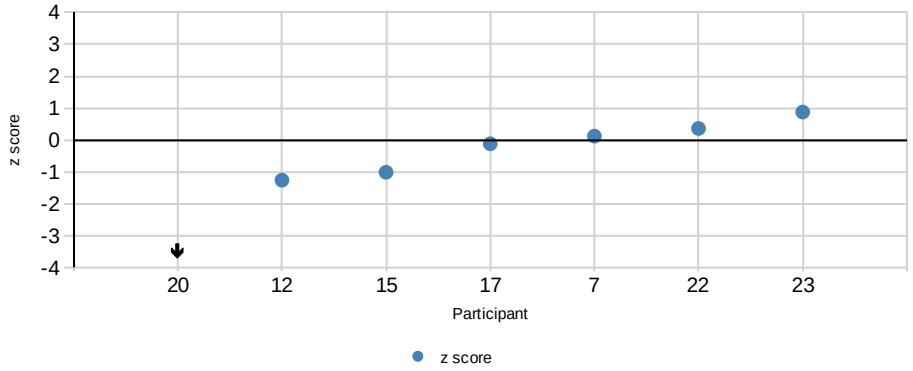



Measurand Mg Sample LN4
z score
4
3
2
1
0
-1
-2
-3
-4
21
2
20
18
14
22
11
Participant
z score

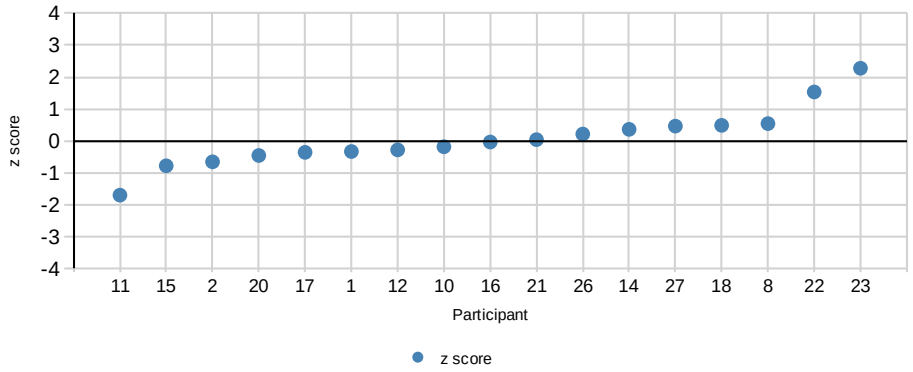

Measurand Mg Sample LO4
z score
4
3
2
1
0
-1
-2
-3
-4
20
1
17
8
16
15
23
12
Participant
z score


Measurand Mg Sample TN3
z score
4
3
2
1
0
-1
-2
-3
-4
4
11
15
20
2
1
21
16
14
26
18
27
6
10
8
Participant
z score

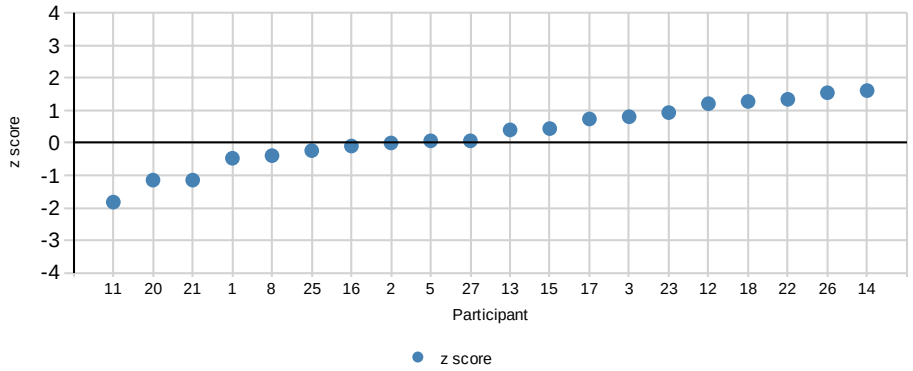
Measurand Mg Sample TY3

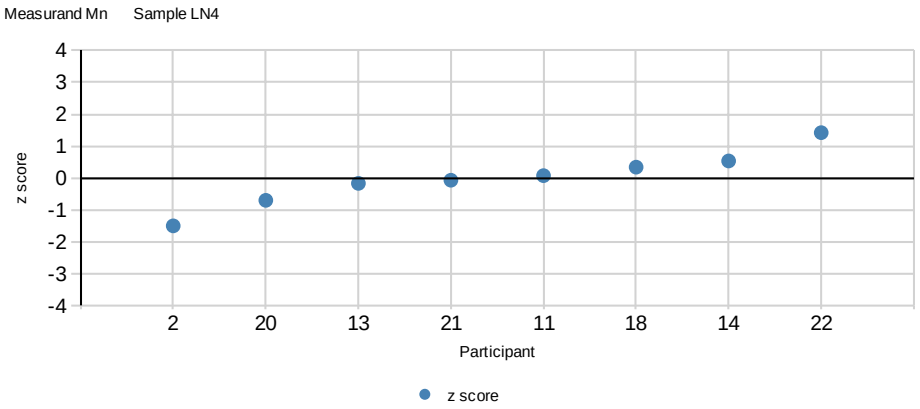


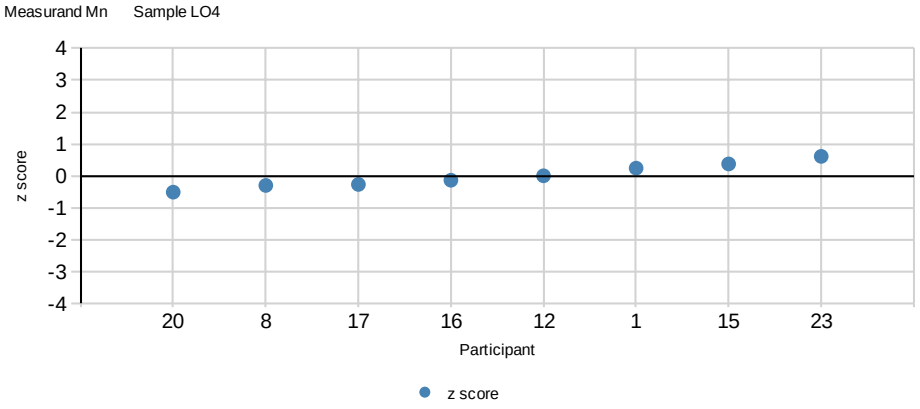
Measurand Mg Sample V2M

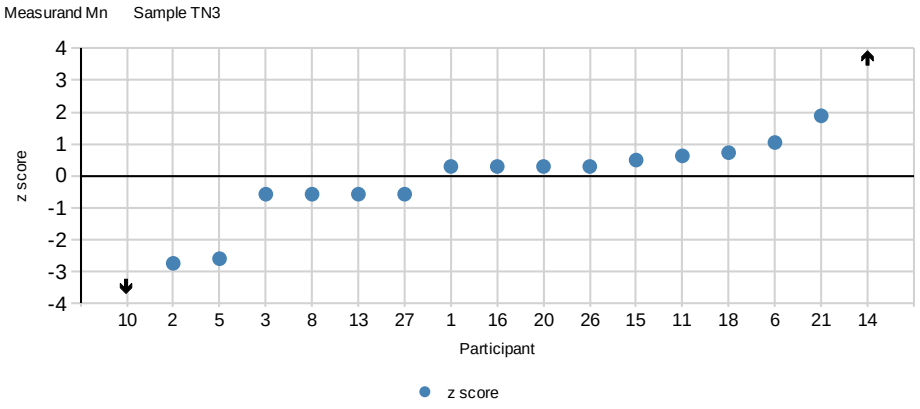


Measurand Mn Sample A1M

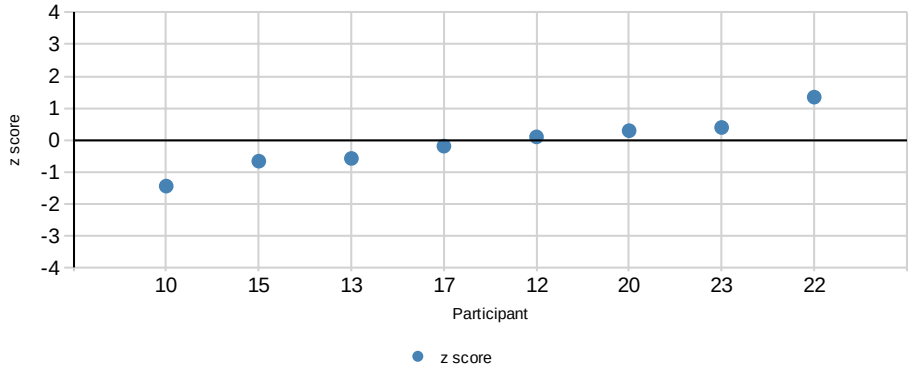



Measurand Mn Sample LN4
z score
4
3
2
1
0
-1
-2
-3
-4
2 20 13 21 11 18 14 22
Participant
z score

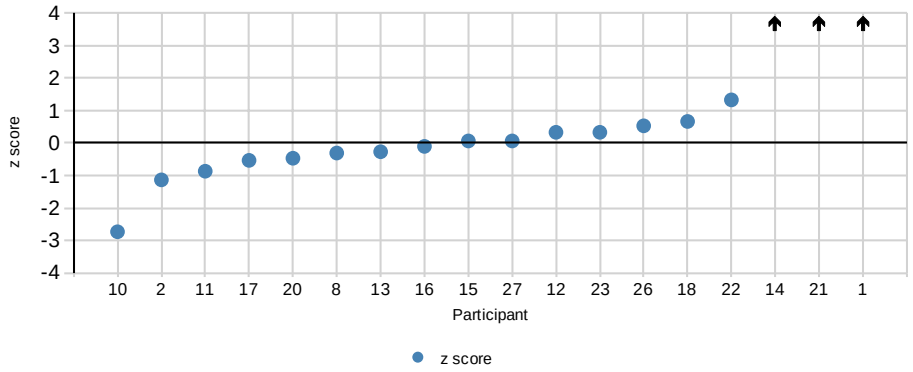

Measurand Mn Sample LO4
z score
4
3
2
1
0
-1
-2
-3
-4
20 8 17 16 12 1 15 23
Participant
z score


Measurand Mn Sample TN3
z score
4
3
2
1
0
-1
-2
-3
-4
10 2 5 3 8 13 27 1 16 20 26 15 11 18 6 21 14
Participant
z score

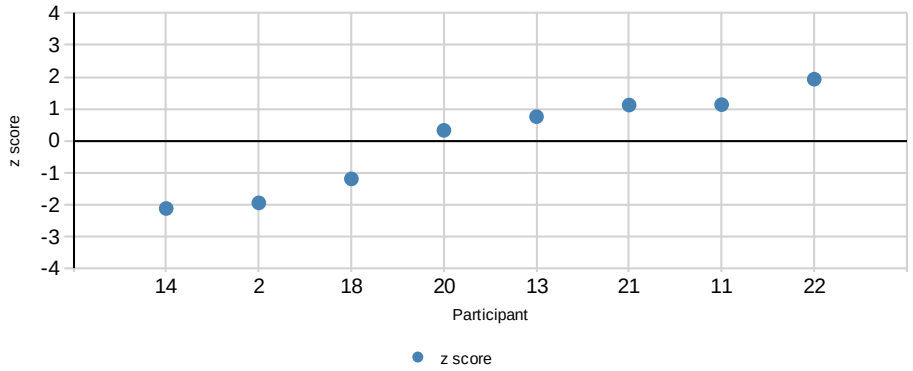
Measurand Mn Sample TY3

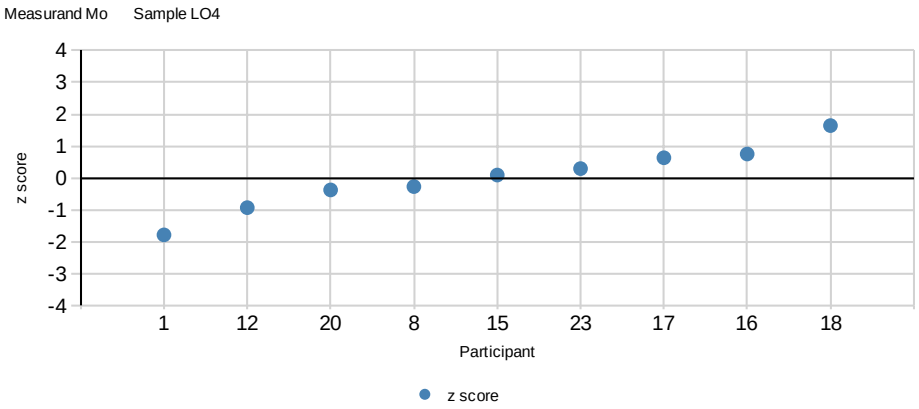


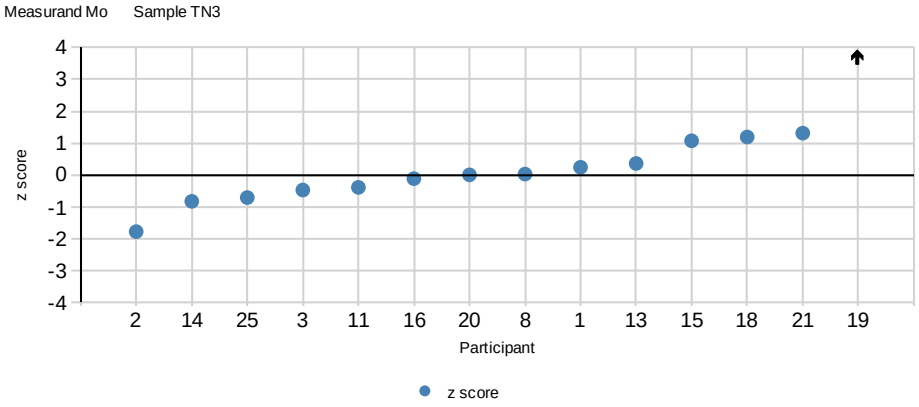
Measurand Mn Sample V2M

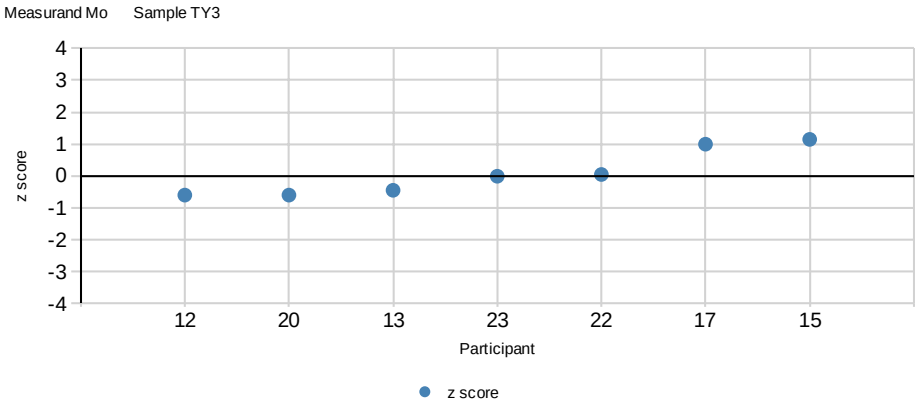


Measurand Mo Sample LN4

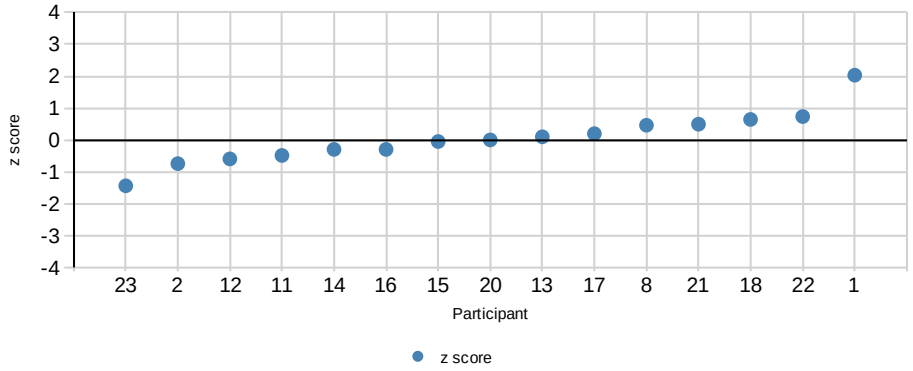



Measurand Mo
Sample LO4
z score
4
3
2
1
0
-1
-2
-3
-4
1
12
20
8
15
23
17
16
18
Participant
z score

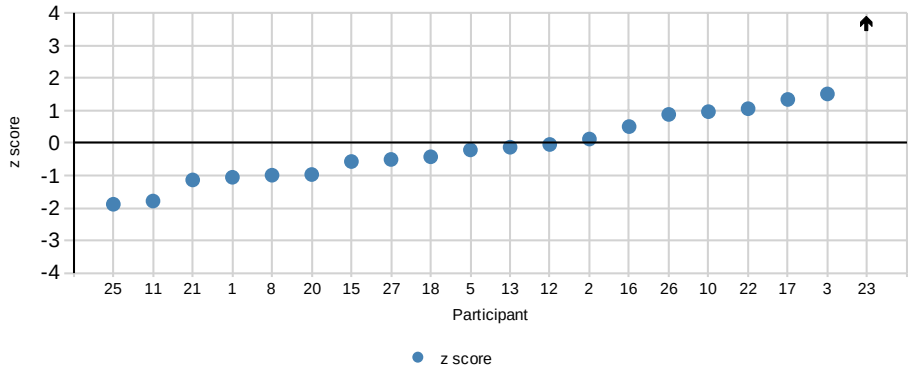

Measurand Mo
Sample TN3
z score
4
3
2
1
0
-1
-2
-3
-4
2
14
25
3
11
16
20
8
1
13
15
18
21
19
Participant
z score


Measurand Mo
Sample TY3
z score
4
3
2
1
0
-1
-2
-3
-4
12
20
13
23
22
17
15
Participant
z score

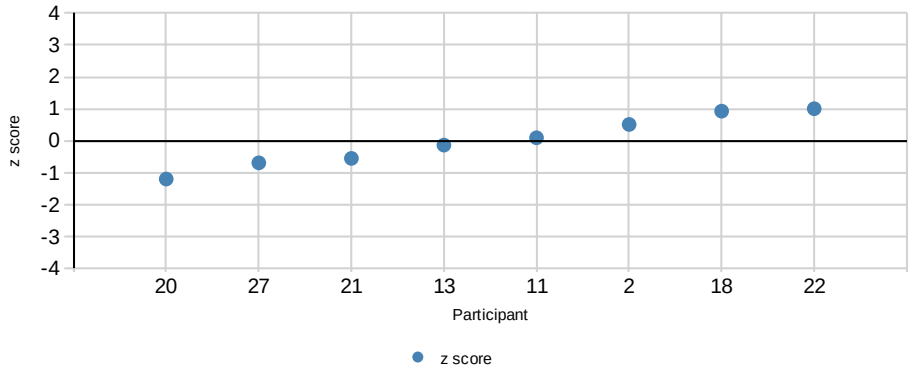
Measurand Mo Sample V2M

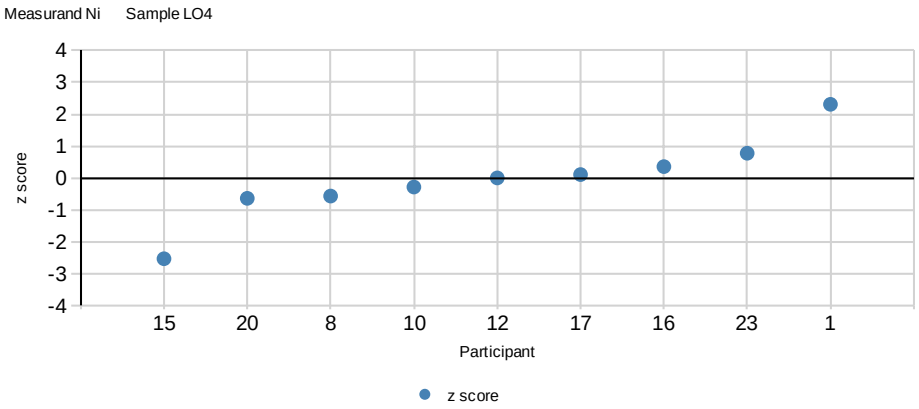


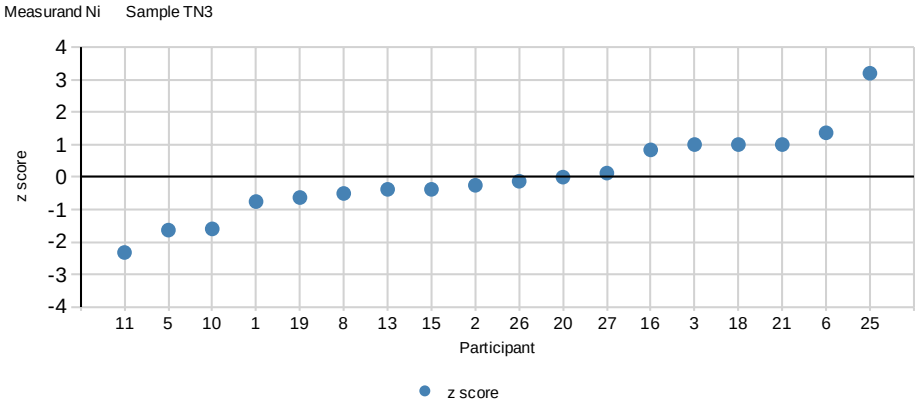
Measurand Ni Sample A1M

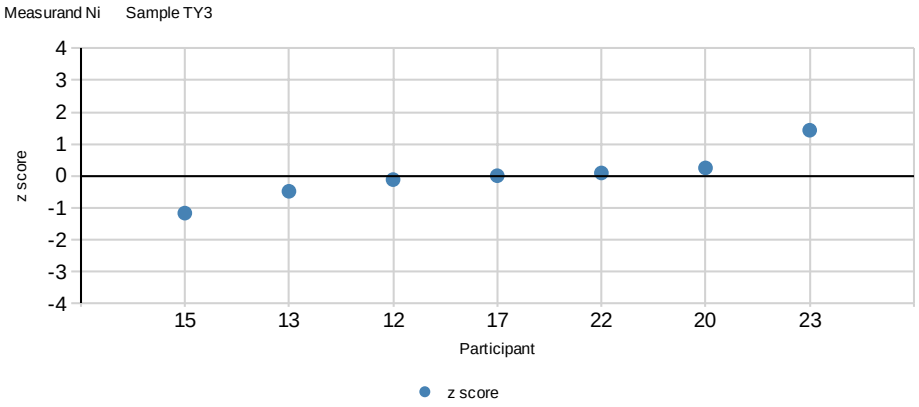


Measurand Ni Sample LN4

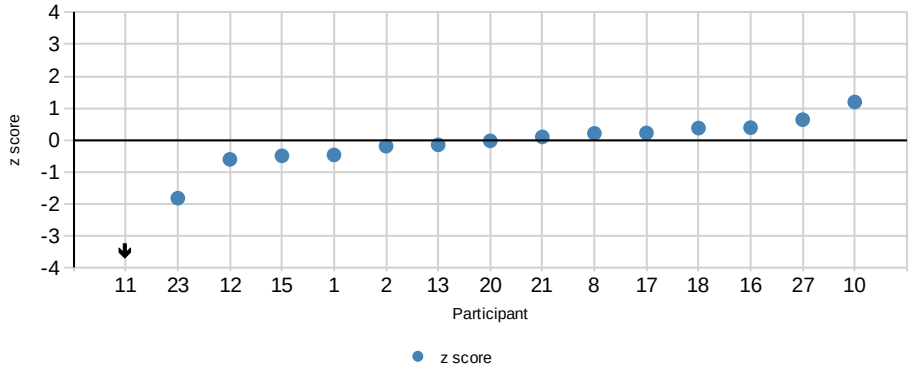



Measurand Ni Sample LO4
z score
4
3
2
1
0
-1
-2
-3
-4
15 20 8 10 12 17 16 23 1
Participant
z score

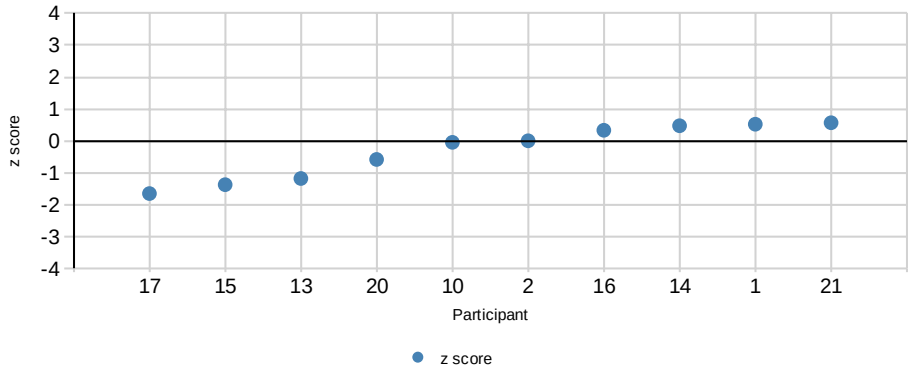

Measurand Ni Sample TN3
z score
4
3
2
1
0
-1
-2
-3
-4
11 5 10 1 19 8 13 15 2 26 20 27 16 3 18 21 6 25
Participant
z score


Measurand Ni Sample TY3
z score
4
3
2
1
0
-1
-2
-3
-4
15 13 12 17 22 20 23
Participant
z score

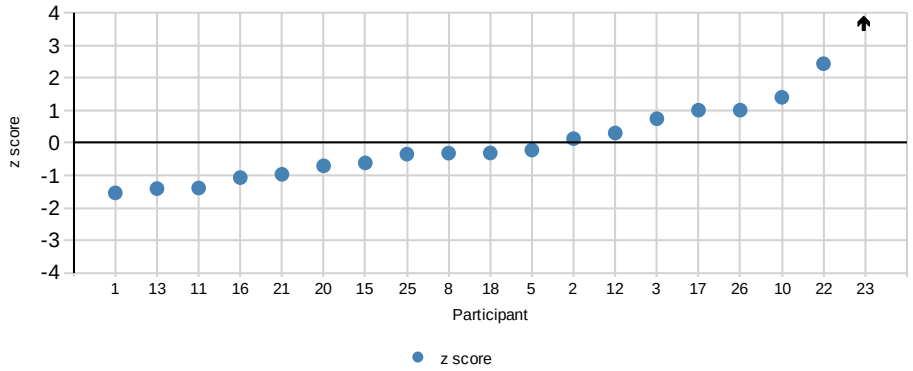
Measurand Ni Sample V2M



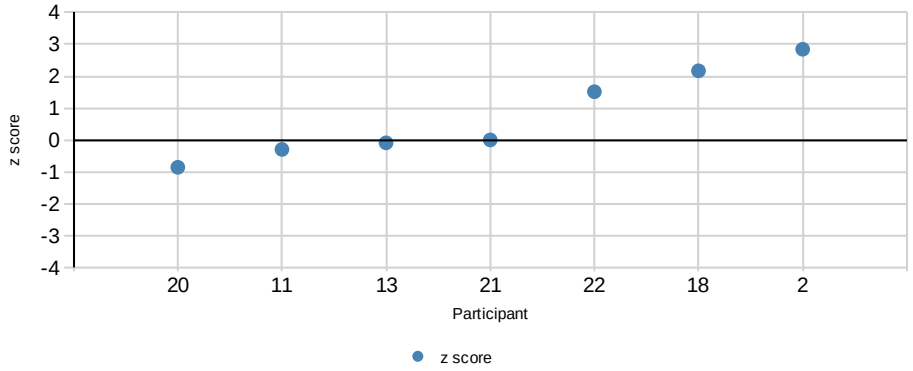
Measurand N_{tot} Sample L4M



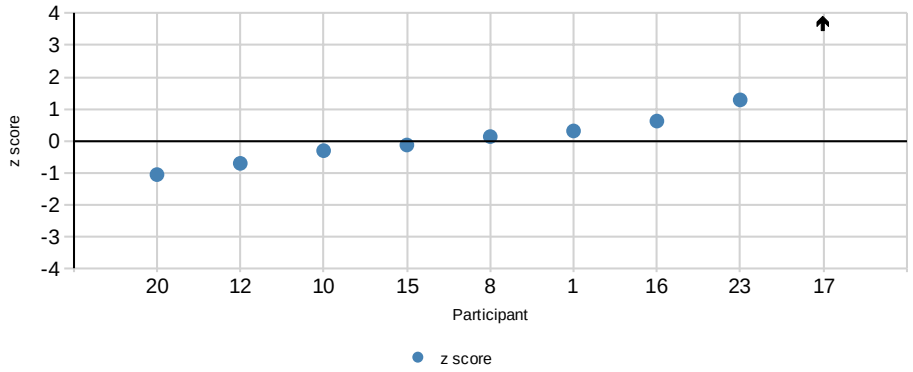
Measurand Pb Sample A1M



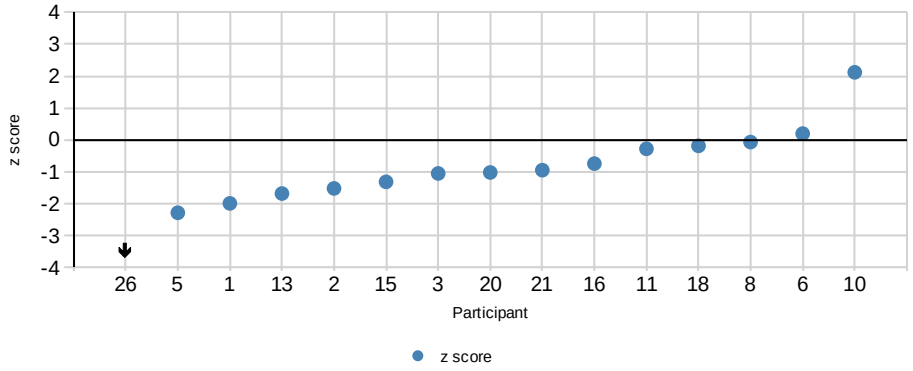
Measurand Pb Sample LN4



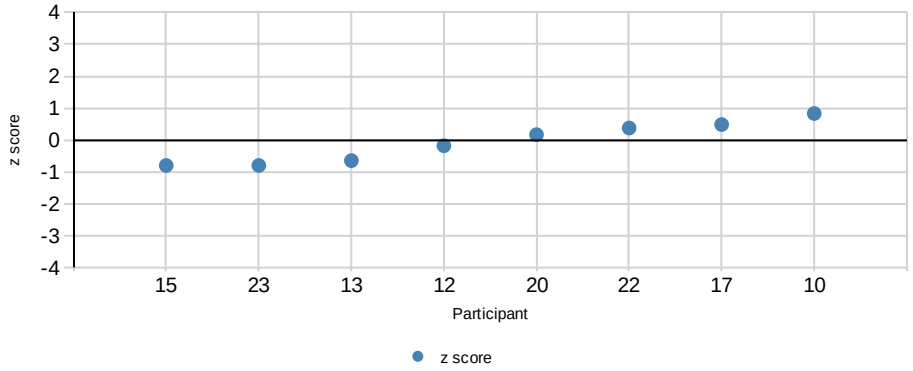
Measurand Pb Sample LO4



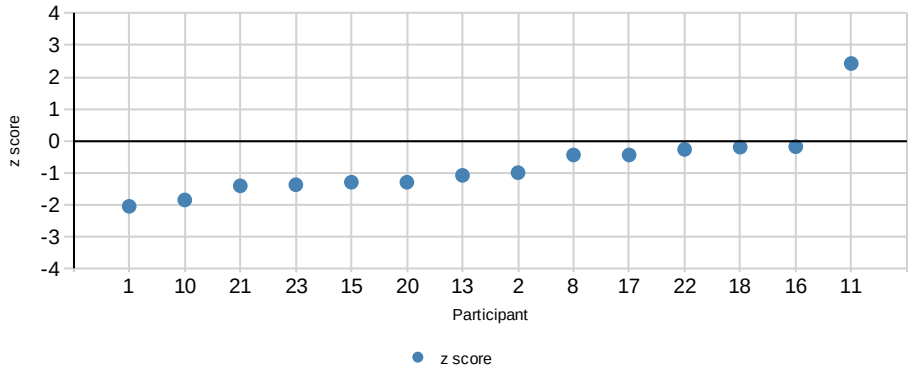
Measurand Pb Sample TN3



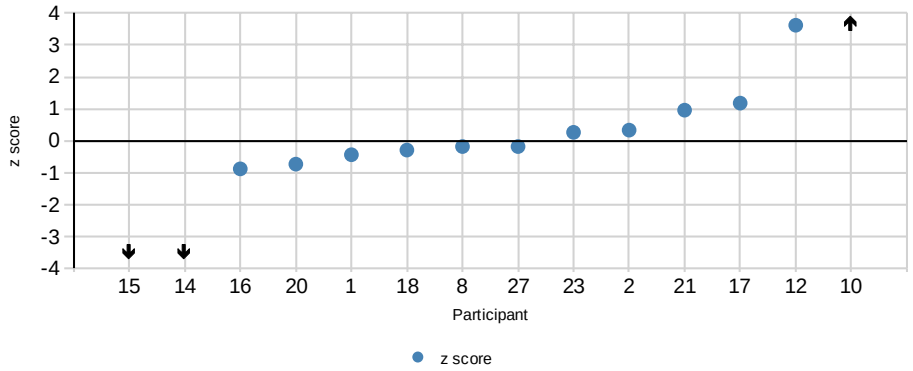
Measurand Pb Sample TY3



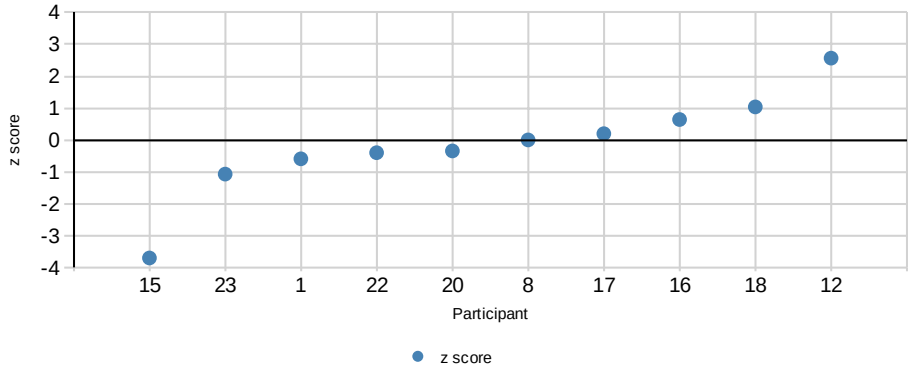
Measurand Pb Sample V2M



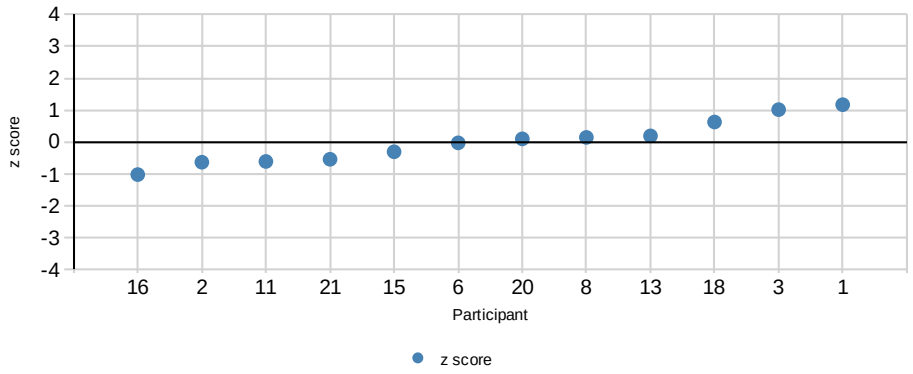
Measurand P_{tot} Sample L4M



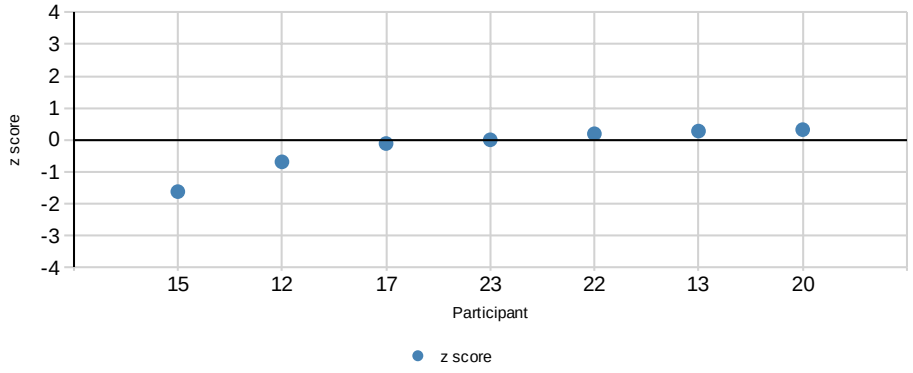
Measurand Sb Sample LO4



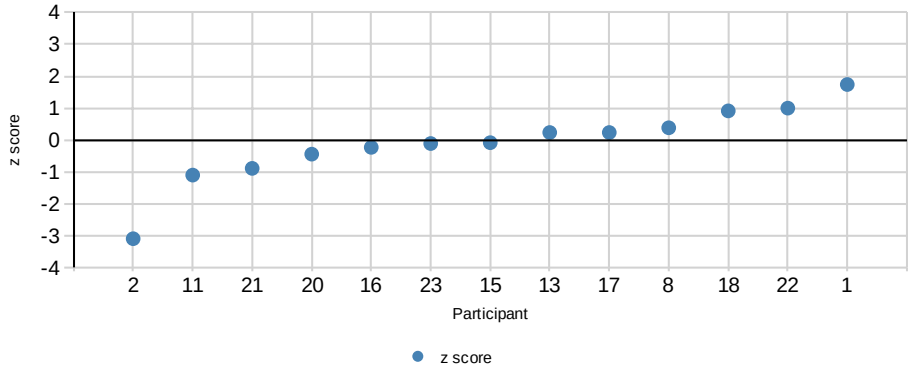
Measurand Sb Sample TN3



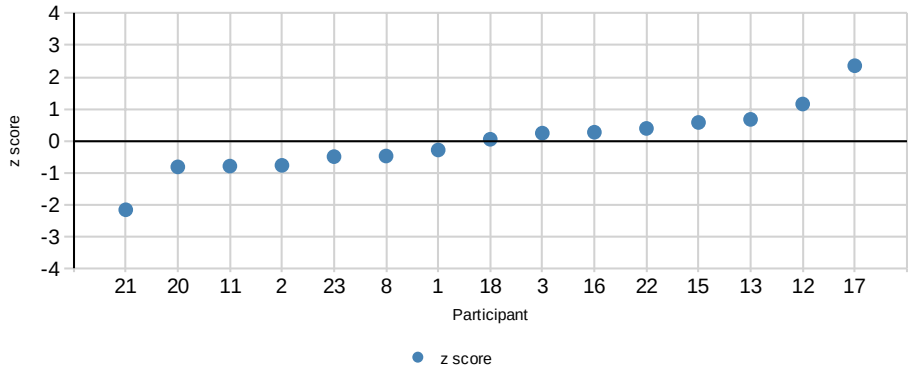
Measurand Sb Sample TY3



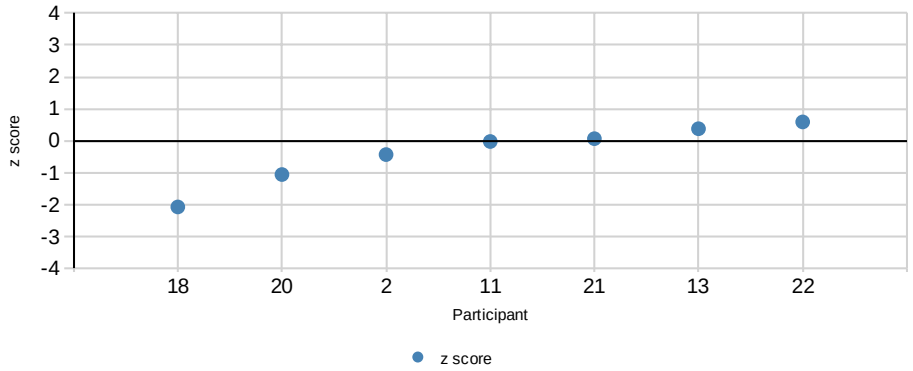
Measurand Sb Sample V2M

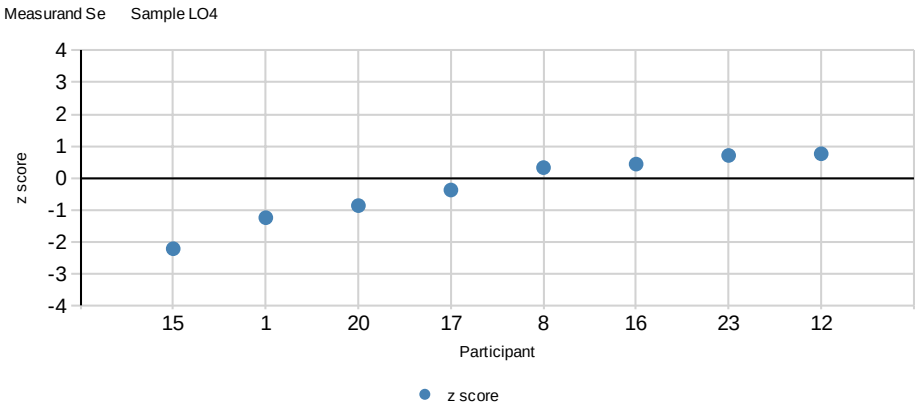


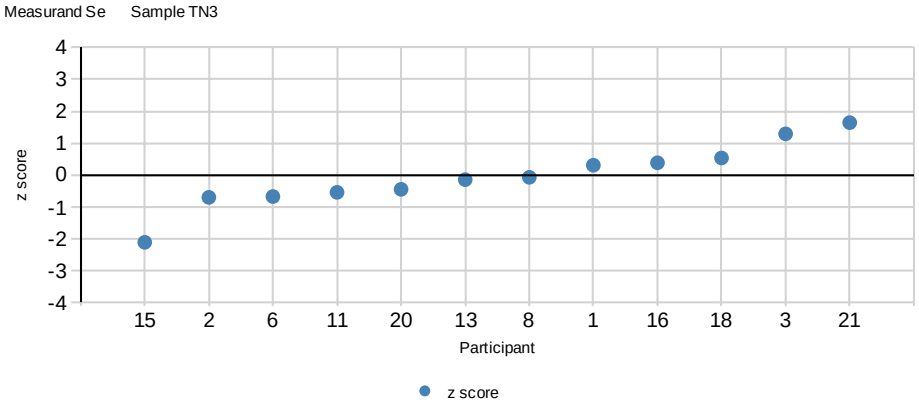
Measurand Se Sample A1M

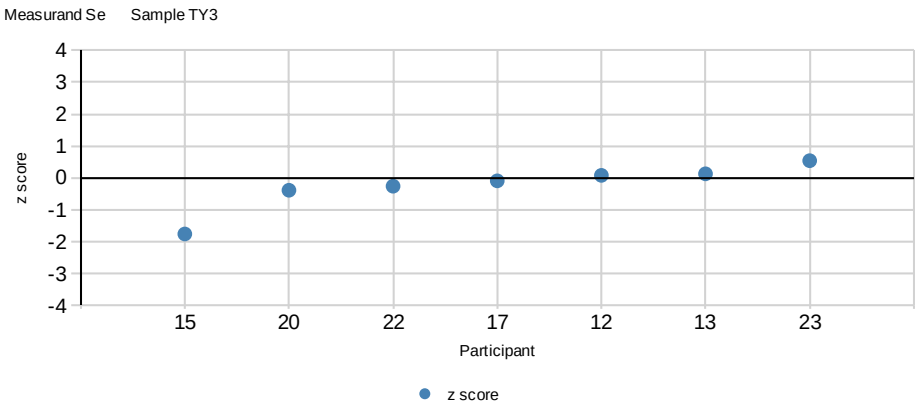


Measurand Se Sample LN4

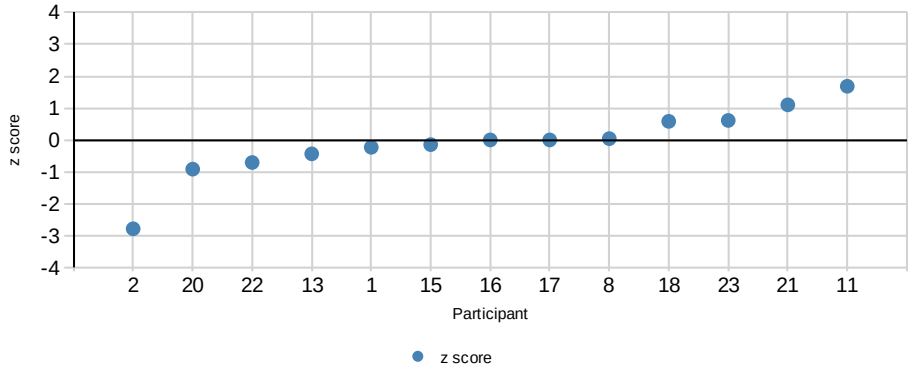



Measurand Se
Sample LO4
z score
4
3
2
1
0
-1
-2
-3
-4
15
1
20
17
8
16
23
12
Participant
z score

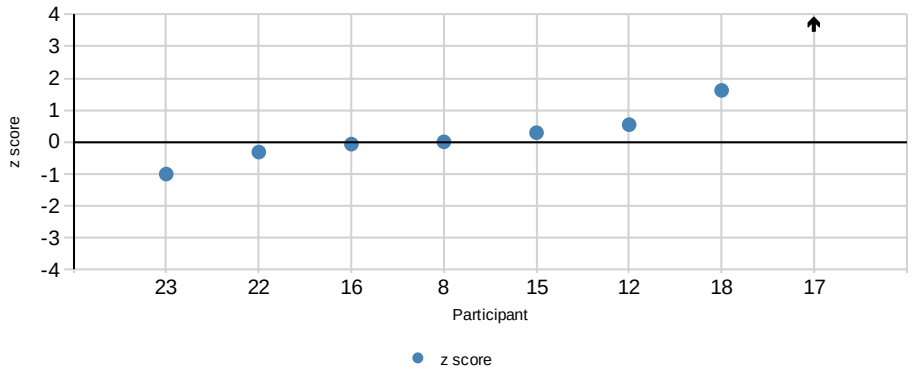

Measurand Se
Sample TN3
z score
4
3
2
1
0
-1
-2
-3
-4
15
2
6
11
20
13
8
1
16
18
3
21
Participant
z score


Measurand Se
Sample TY3
z score
4
3
2
1
0
-1
-2
-3
-4
15
20
22
17
12
13
23
Participant
z score

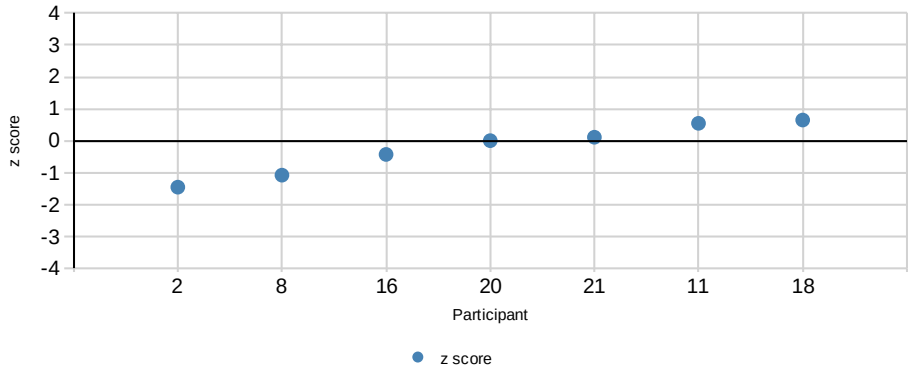
Measurand Se Sample V2M

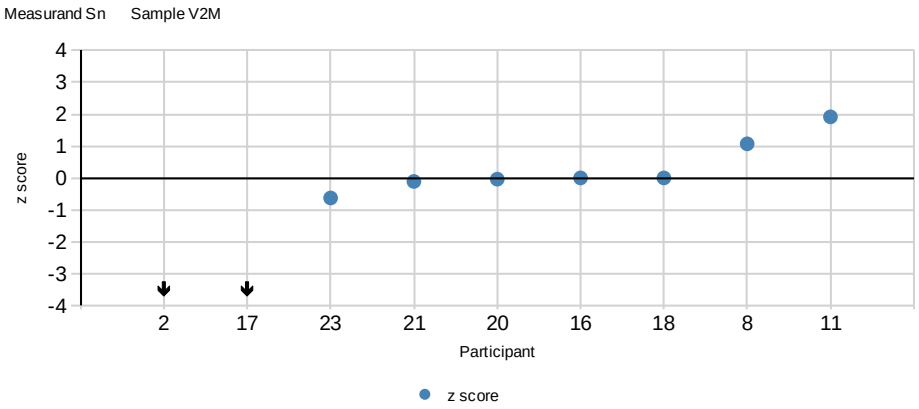


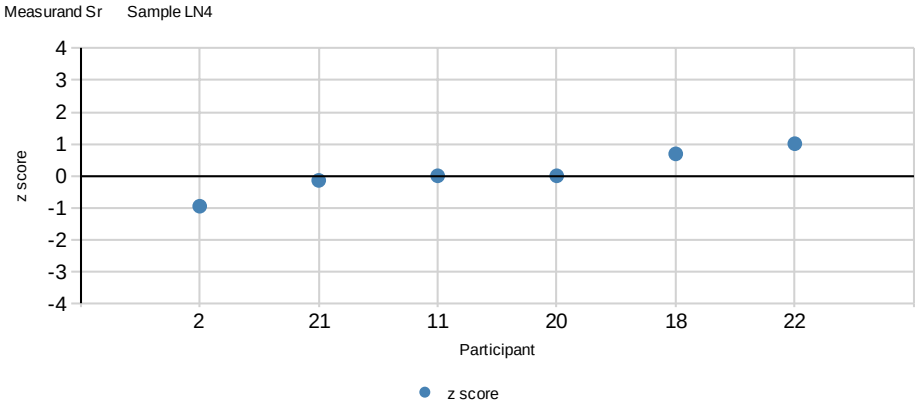
Measurand Sn Sample LO4

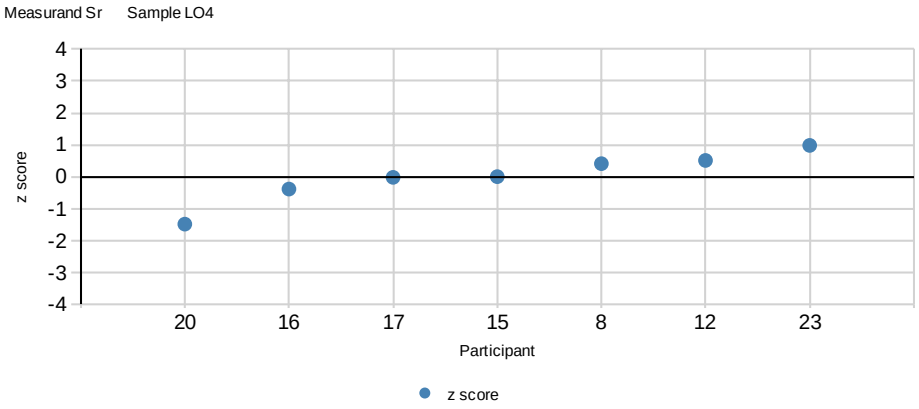


Measurand Sn Sample TN3

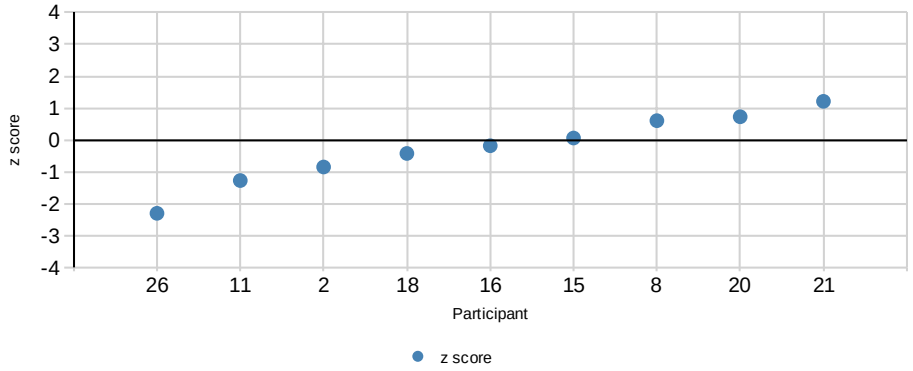



Measurand Sn Sample V2M
z score
4
3
2
1
0
-1
-2
-3
-4
2
17
23
21
20
16
18
8
11
Participant
z score

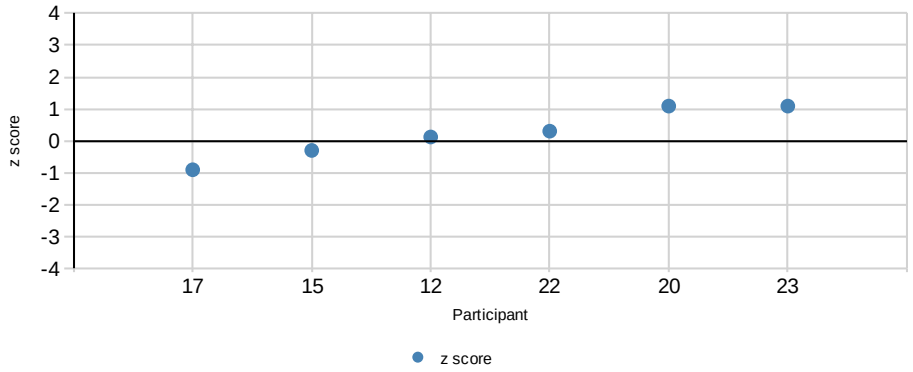

Measurand Sr Sample LN4
z score
4
3
2
1
0
-1
-2
-3
-4
2
21
11
20
18
22
Participant
z score


Measurand Sr Sample LO4
z score
4
3
2
1
0
-1
-2
-3
-4
20
16
17
15
8
12
23
Participant
z score

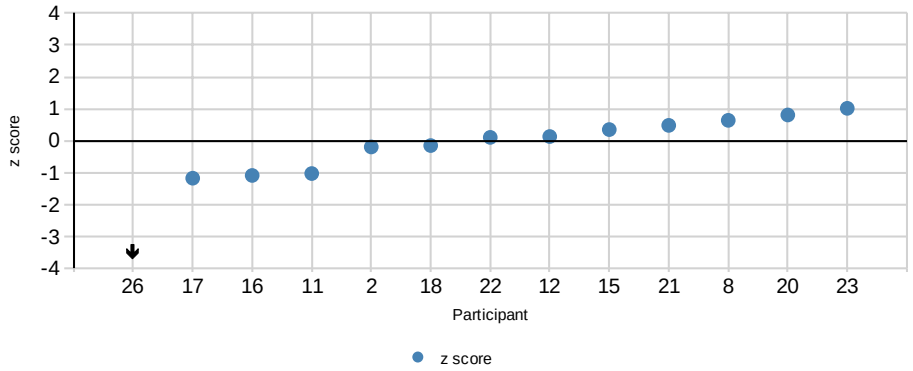
Measurand Sr Sample TN3

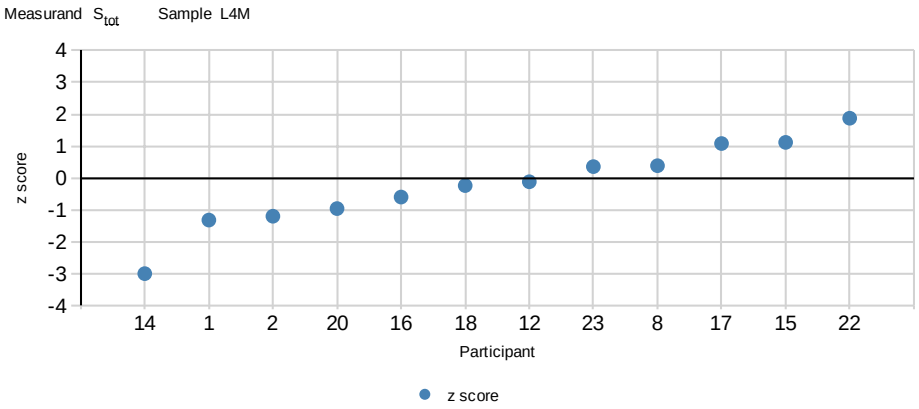


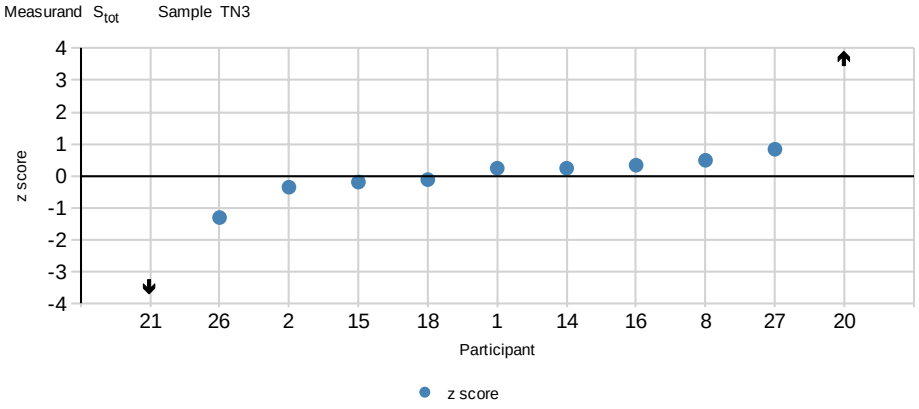
Measurand Sr Sample TY3

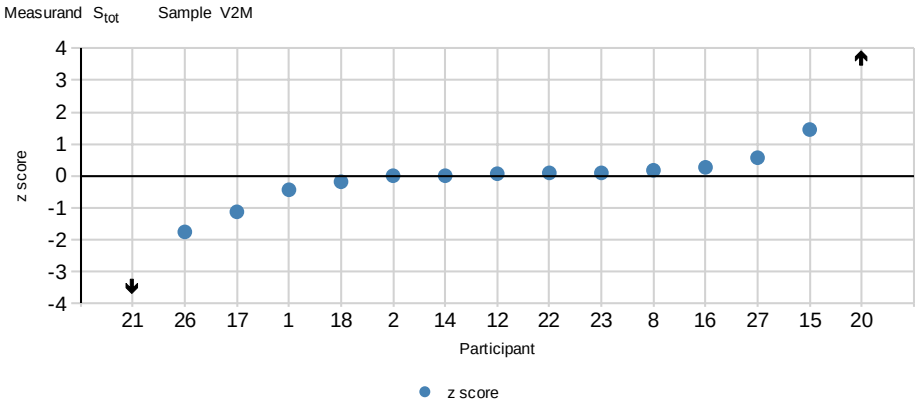


Measurand Sr Sample V2M

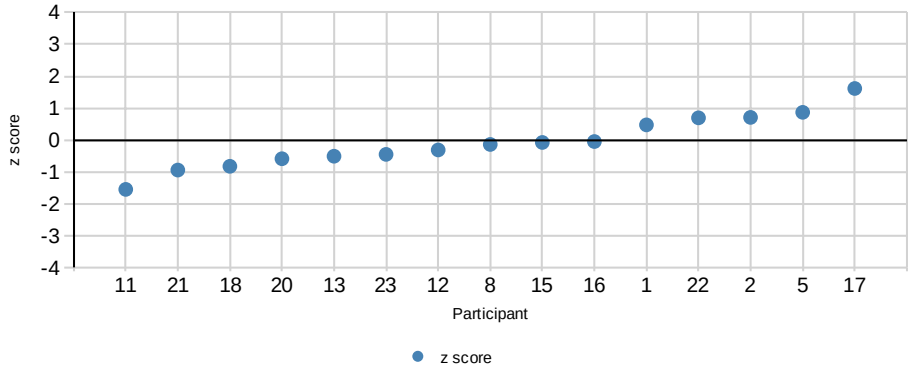



Measurand S_{tot} Sample L4M
z score
4
3
2
1
0
-1
-2
-3
-4
14 1 2 20 16 18 12 23 8 17 15 22
Participant
z score

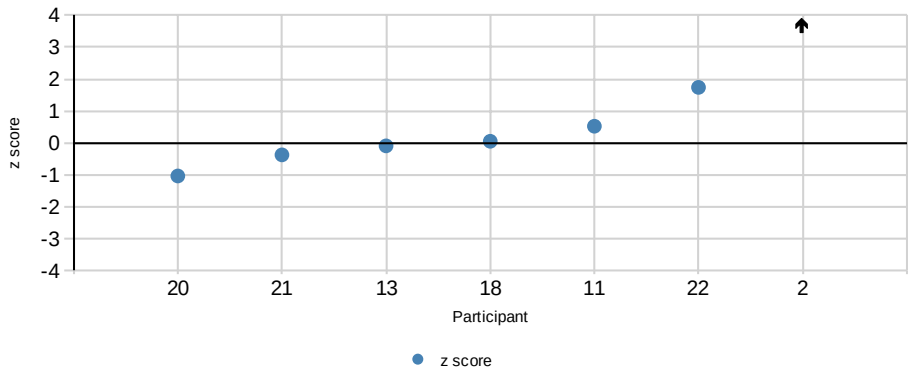

Measurand S_{tot} Sample TN3
z score
4
3
2
1
0
-1
-2
-3
-4
21 26 2 15 18 1 14 16 8 27 20
Participant
z score


Measurand S_{tot} Sample V2M
z score
4
3
2
1
0
-1
-2
-3
-4
21 26 17 1 18 2 14 12 22 23 8 16 27 15 20
Participant
z score

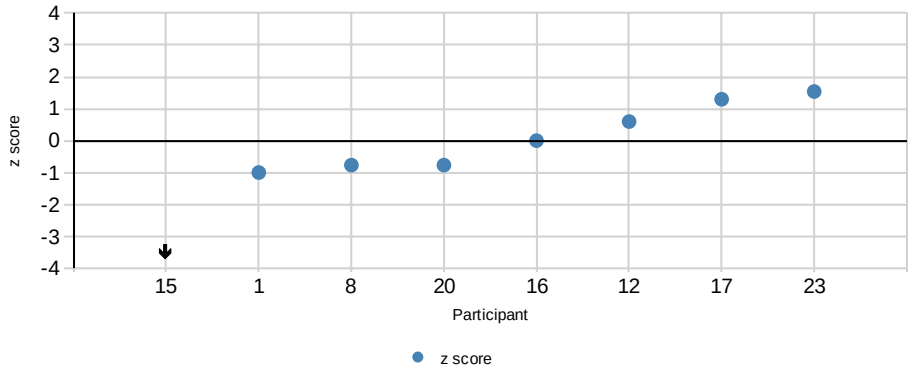
Measurand V Sample A1M

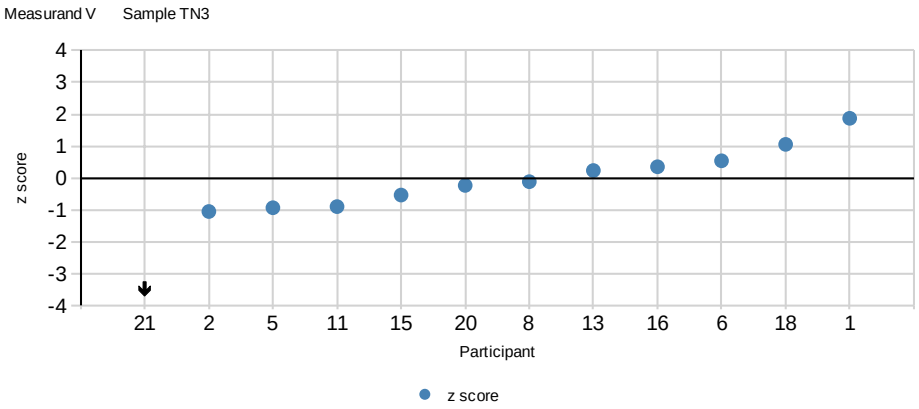


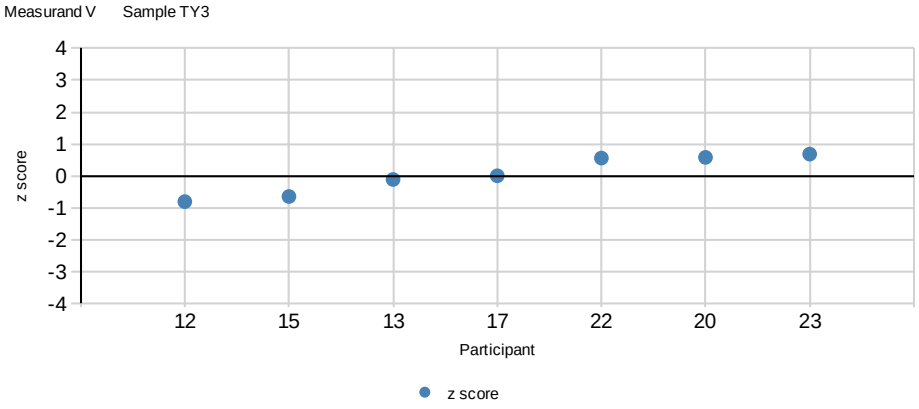
Measurand V Sample LN4

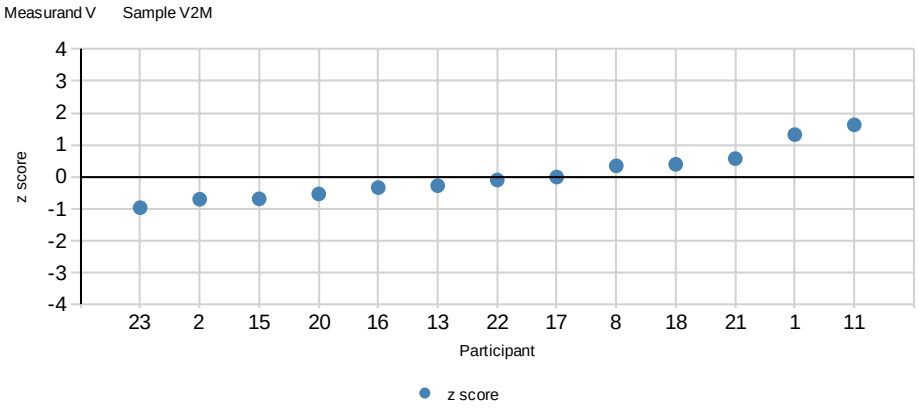


Measurand V Sample LO4

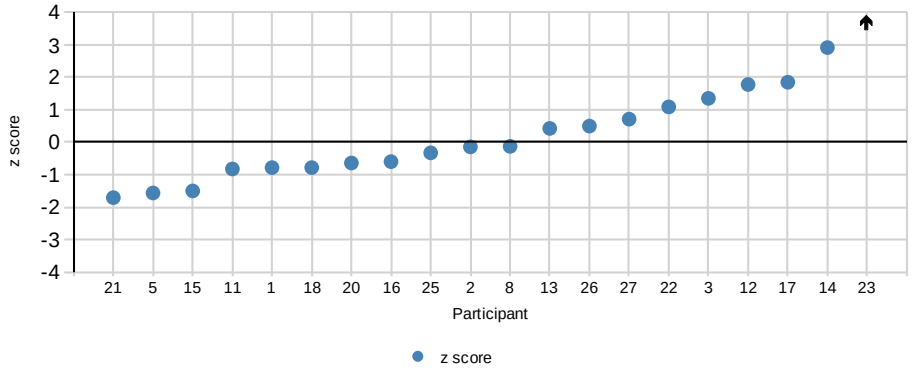



Measurand V
Sample TN3
z score
4
3
2
1
0
-1
-2
-3
-4
21
2
5
11
15
20
8
13
16
6
18
1
Participant
z score

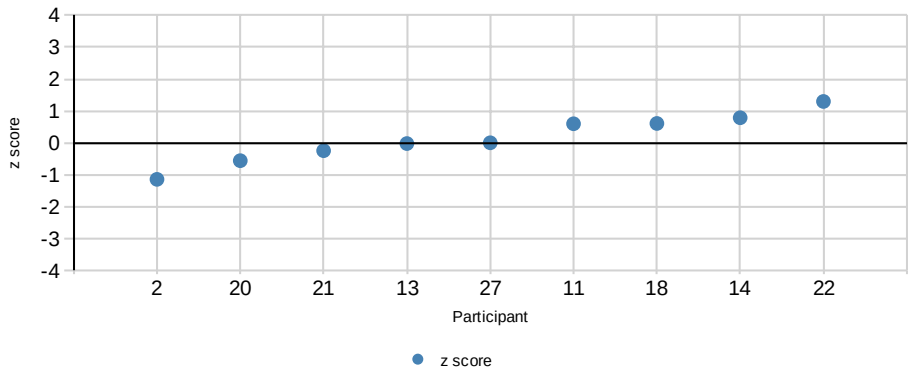

Measurand V
Sample TY3
z score
4
3
2
1
0
-1
-2
-3
-4
12
15
13
17
22
20
23
Participant
z score


Measurand V
Sample V2M
z score
4
3
2
1
0
-1
-2
-3
-4
23
2
15
20
16
13
22
17
8
18
21
1
11
Participant
z score

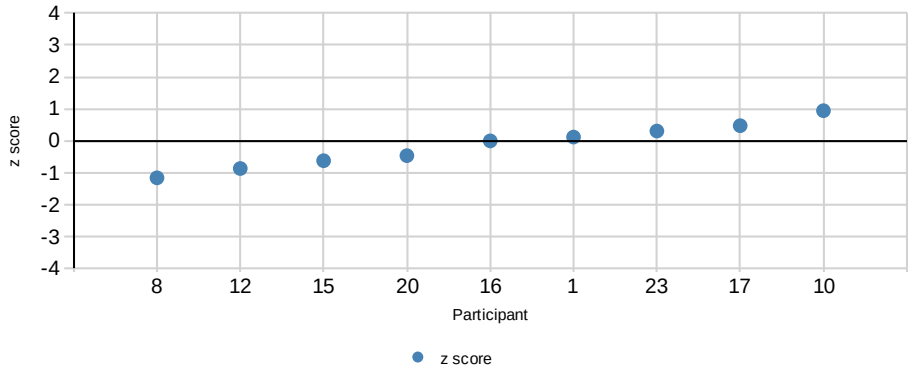
Measurand Zn Sample A1M

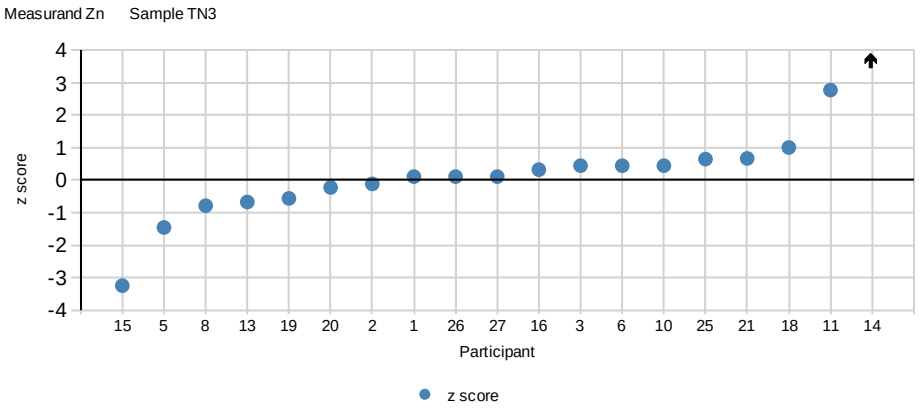


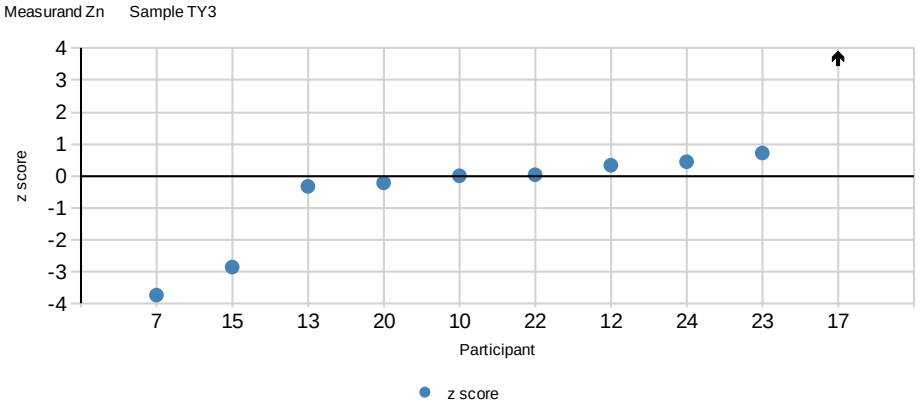
Measurand Zn Sample LN4

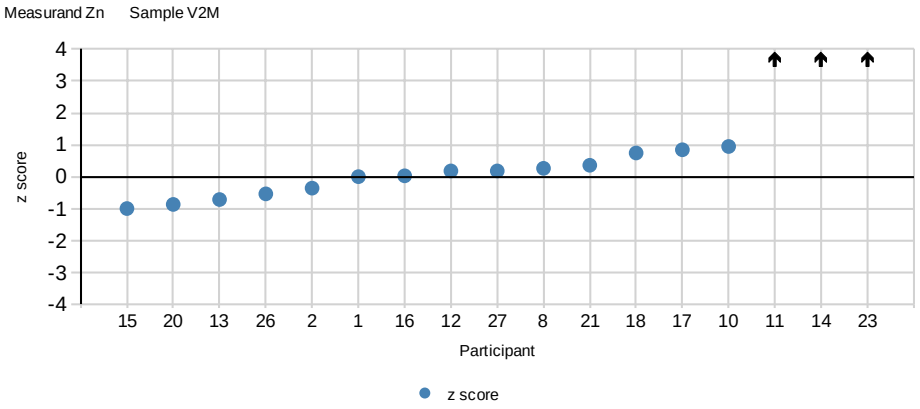


Measurand Zn Sample LO4



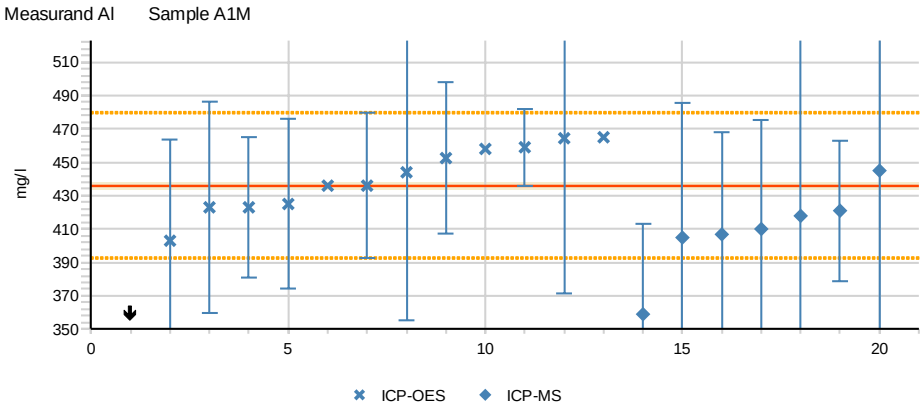

Measurand Zn Sample TN3
z score
4
3
2
1
0
-1
-2
-3
-4
15 5 8 13 19 20 2 1 26 27 16 3 6 10 25 21 18 11 14
Participant
z score

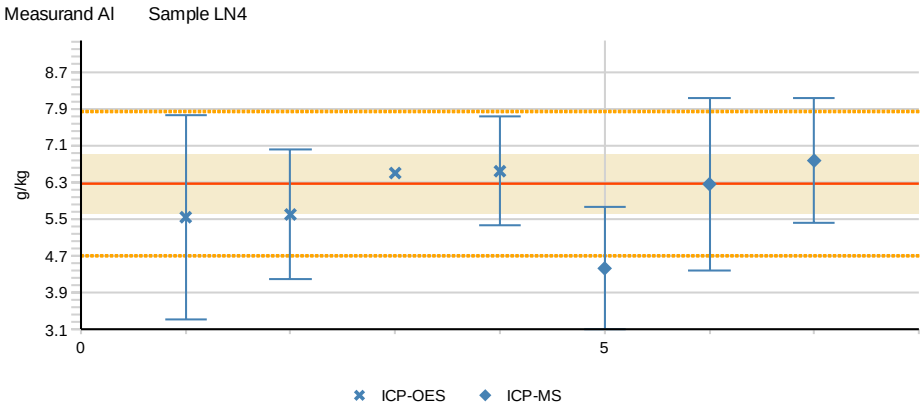

Measurand Zn Sample TY3
z score
4
3
2
1
0
-1
-2
-3
-4
7 15 13 20 10 22 12 24 23 17
Participant
z score

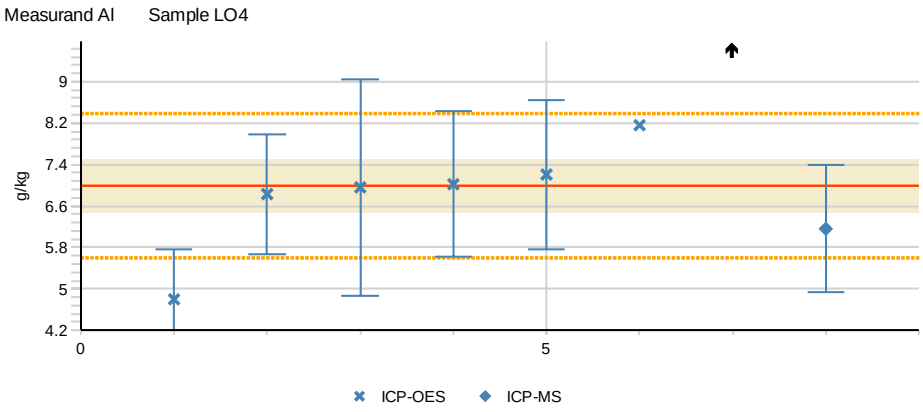

Measurand Zn Sample V2M
z score
4
3
2
1
0
-1
-2
-3
-4
15 20 13 26 2 1 16 12 27 8 21 18 17 10 11 14 23
Participant
z score

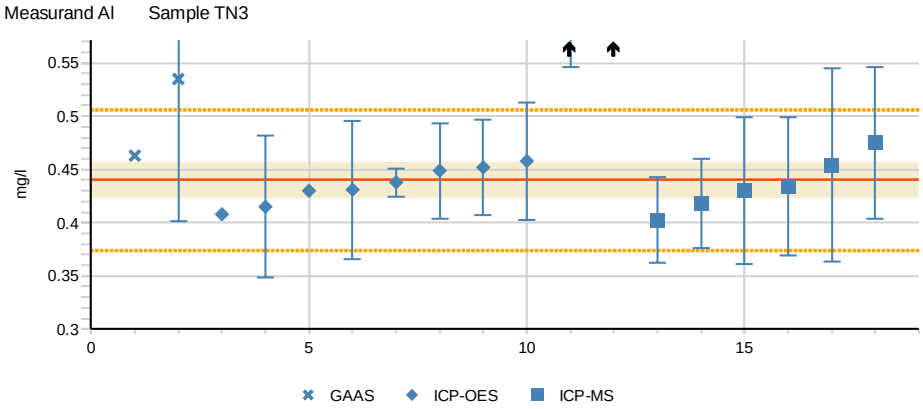
APPENDIX 11: Results grouped according to the methods

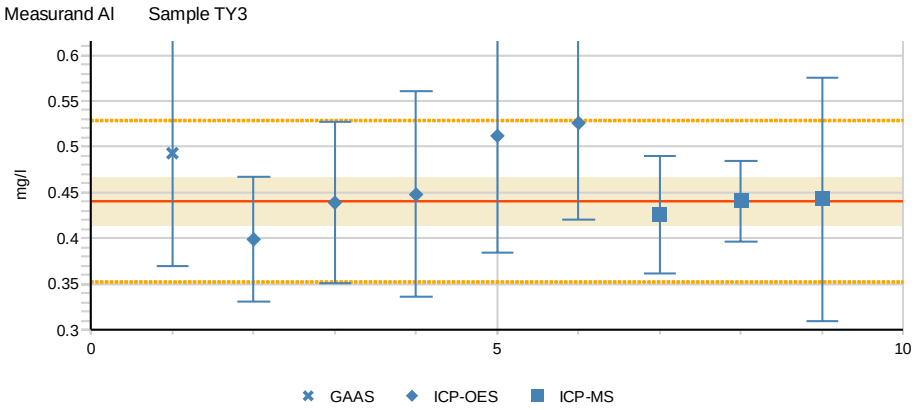
In figures:
The dashed lines describe the standard deviation for the proficiency assessment, the red solid line shows the assigned value, the shaded area describes the expanded measurement uncertainty of the assigned value, and the arrow describes the value outside the scale. The results are shown in ascending order.

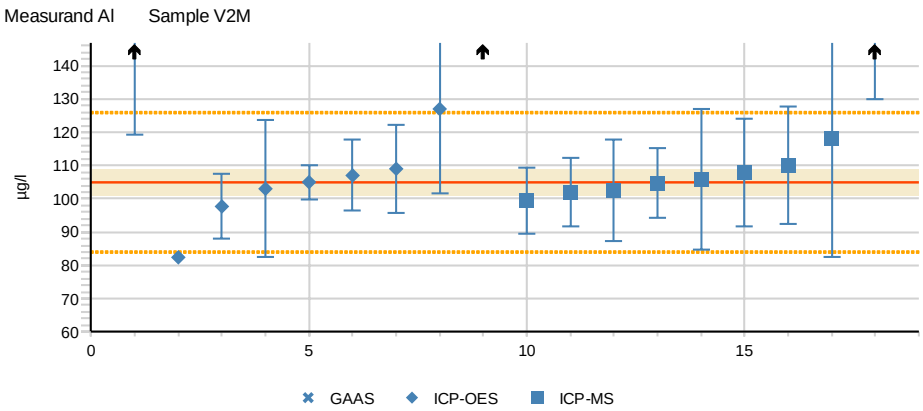




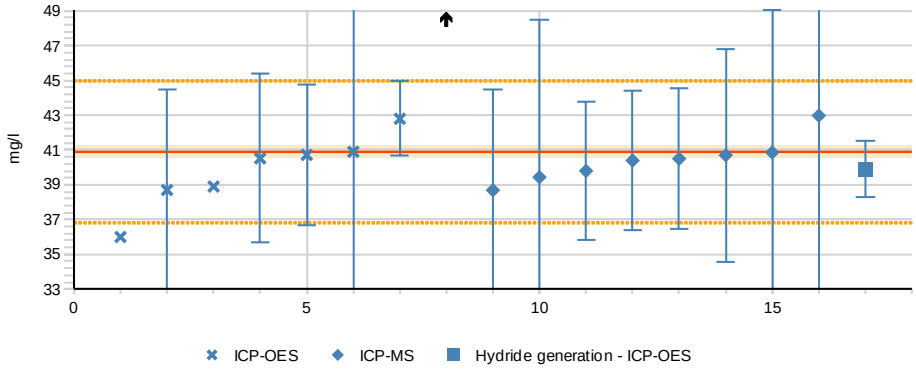



Measurand Al
Sample TN3
mg/l
0.55
0.5
0.45
0.4
0.35
0.3
0
5
10
15
GAAS
ICP-OES
ICP-MS

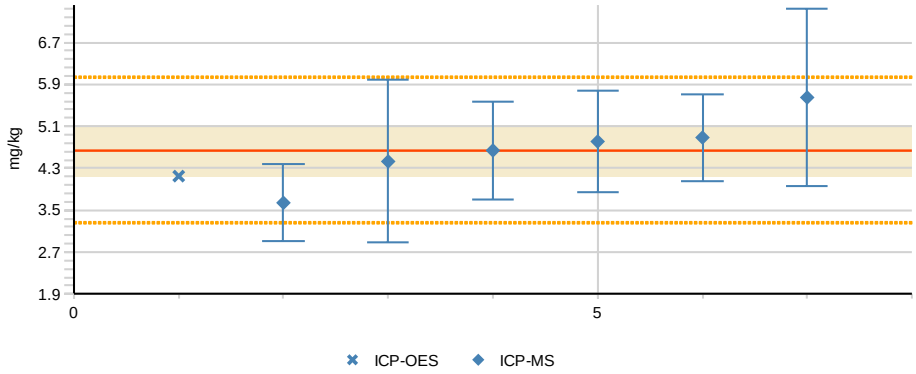

Measurand Al
Sample TY3
mg/l
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0
5
10
GAAS
ICP-OES
ICP-MS


Measurand Al
Sample V2M
µg/l
140
130
120
110
100
90
80
70
60
0
5
10
15
GAAS
ICP-OES
ICP-MS

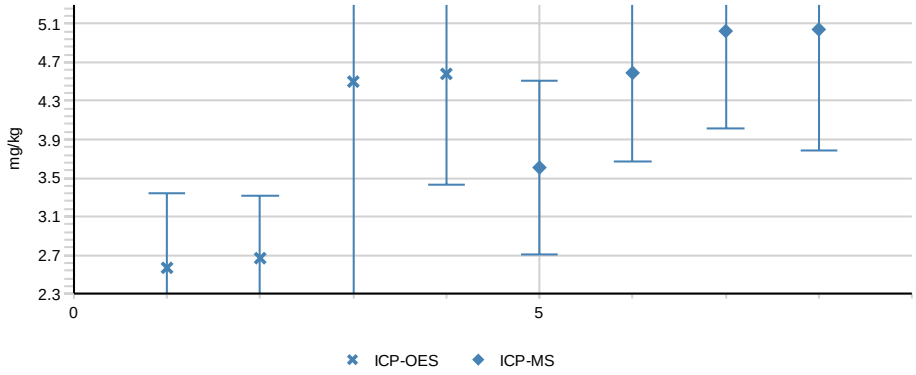
Measurand As Sample A1M



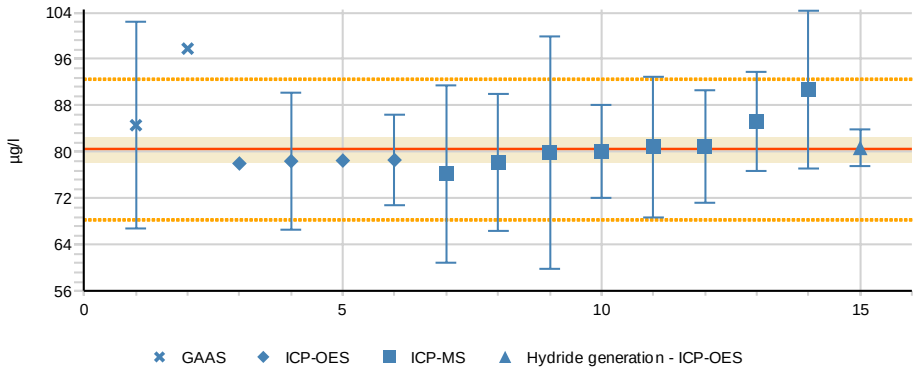
Measurand As Sample LN4



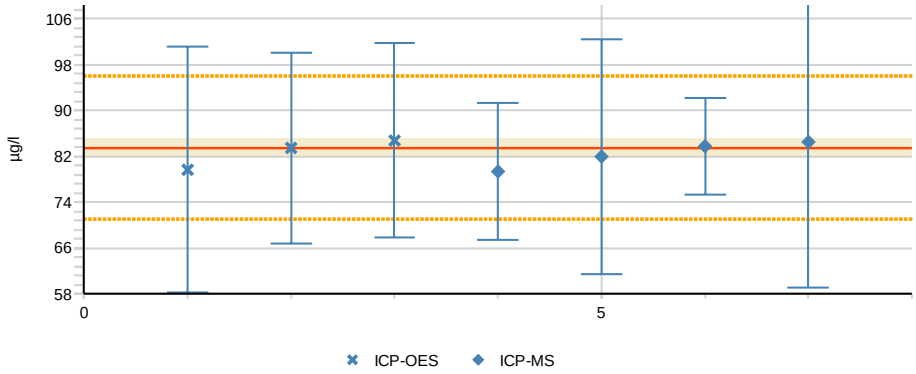
Measurand As Sample LO4



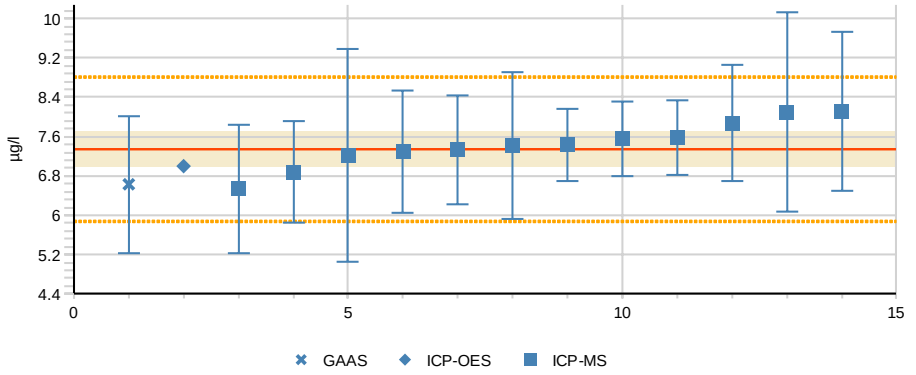
Measurand As Sample TN3



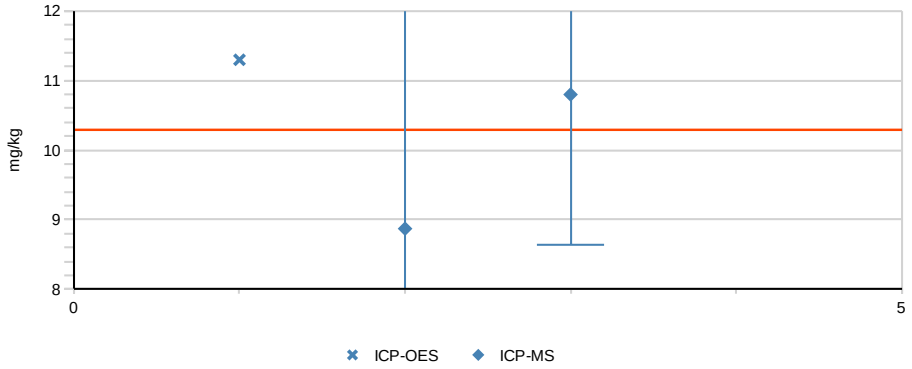
Measurand As Sample TY3



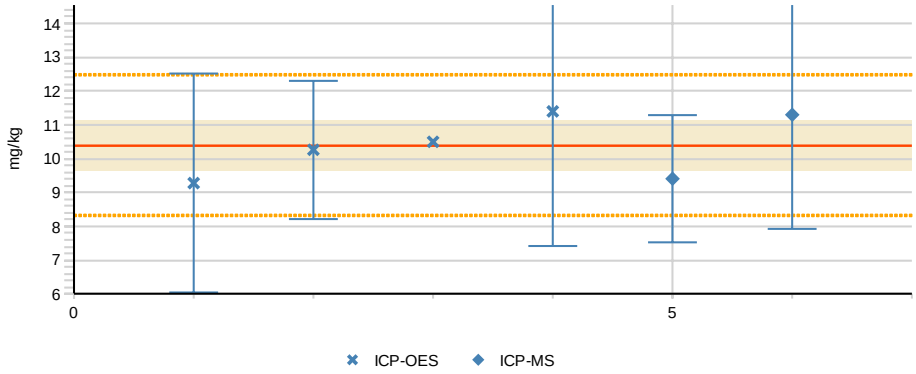
Measurand As Sample V2M



Measurand B Sample LN4



Measurand B Sample LO4



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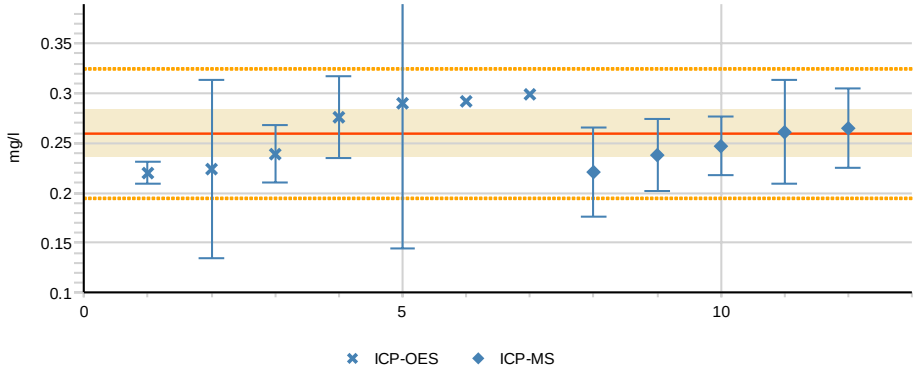

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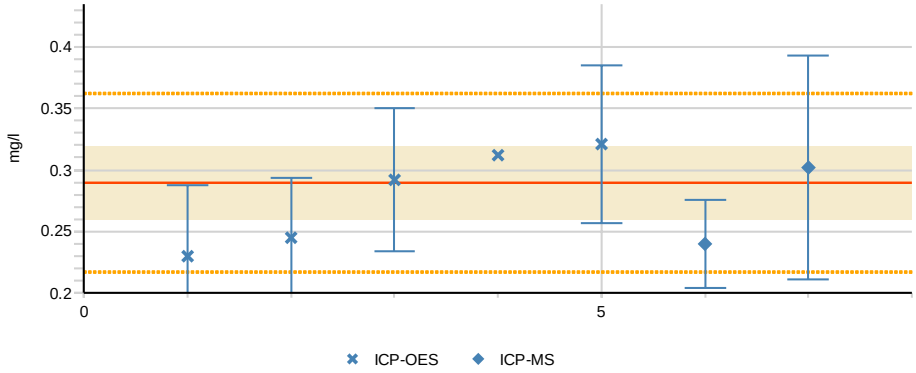
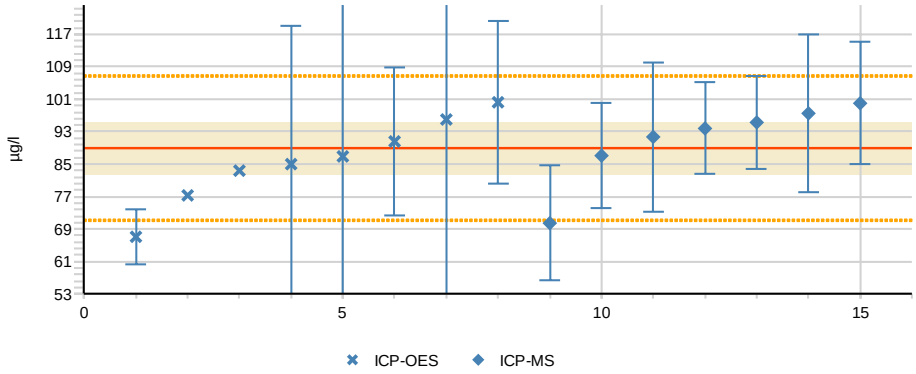
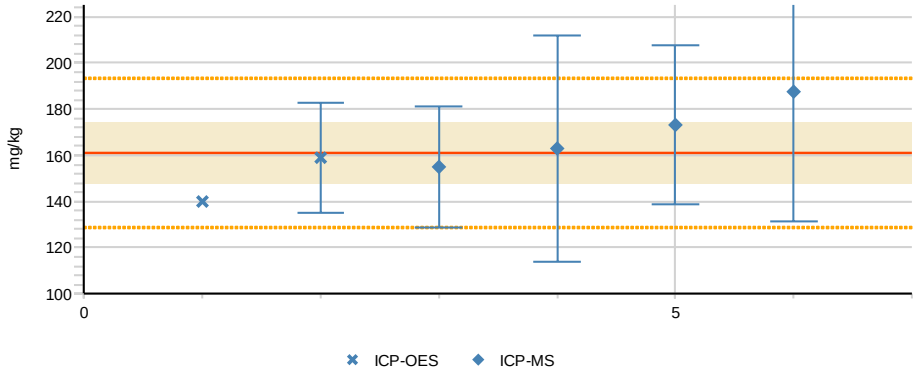


Measurand B Sample V2M



Measurand Ba Sample LN4



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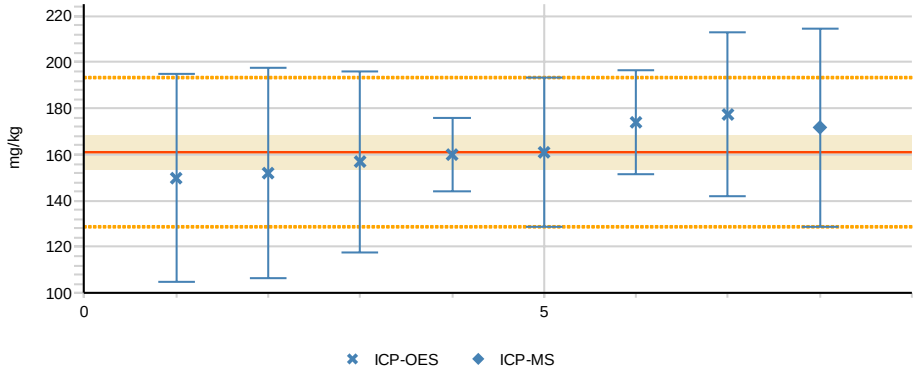
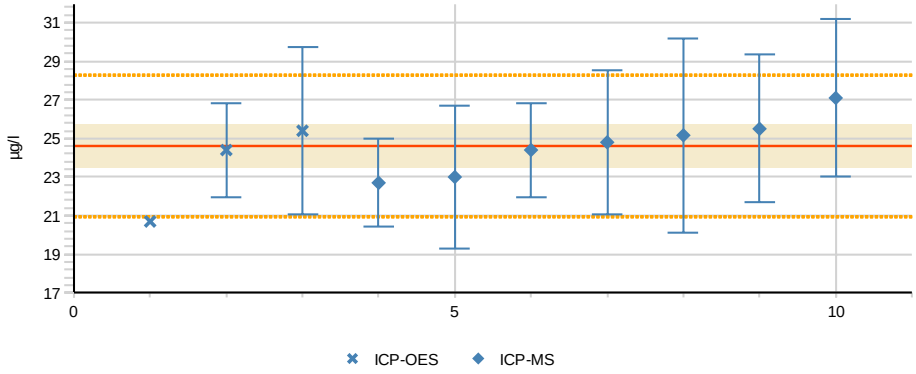


Measurand Ba Sample TN3



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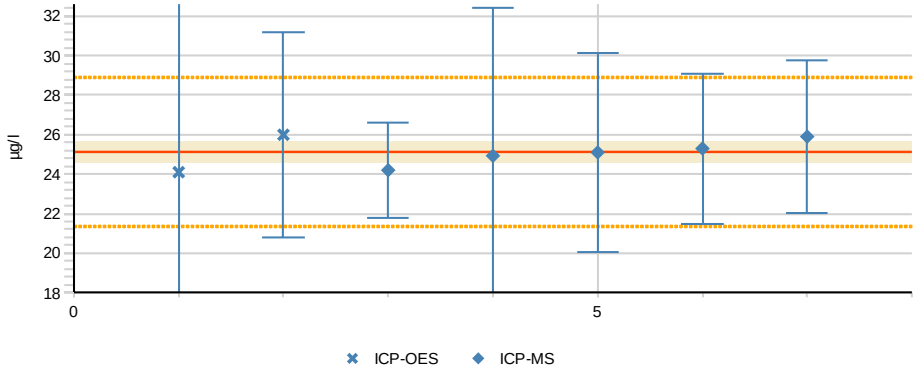

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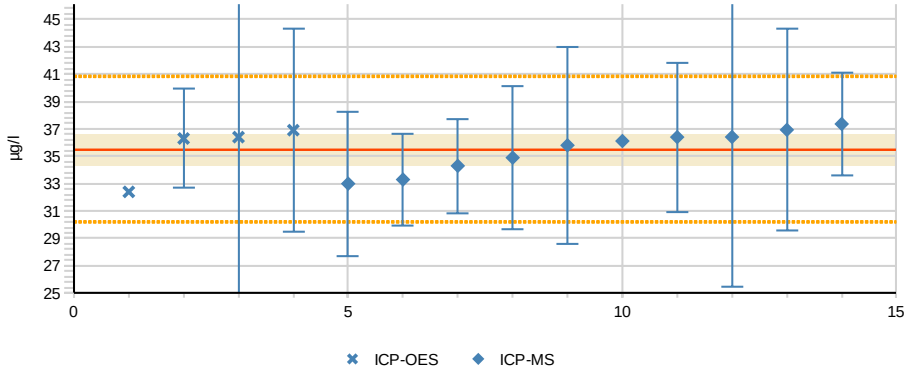
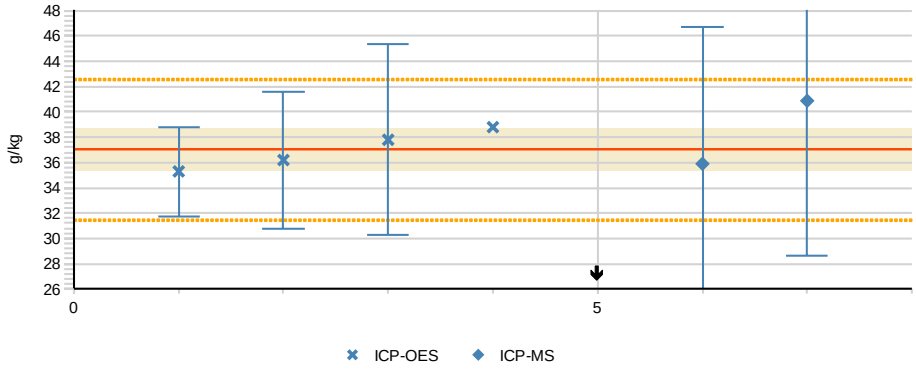


Measurand Ca Sample LN4



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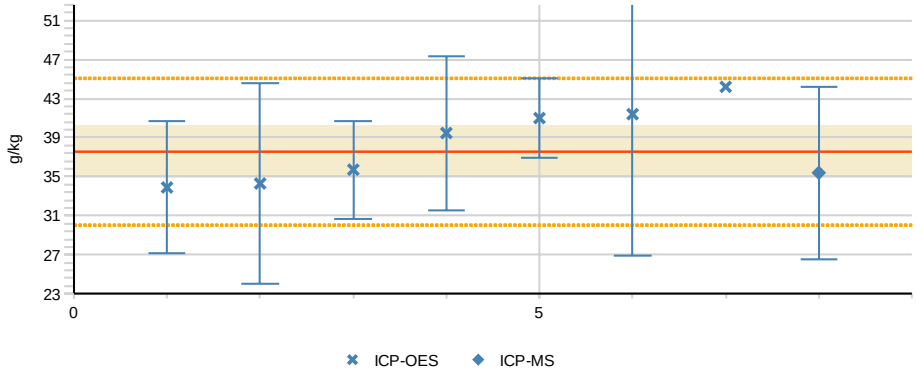

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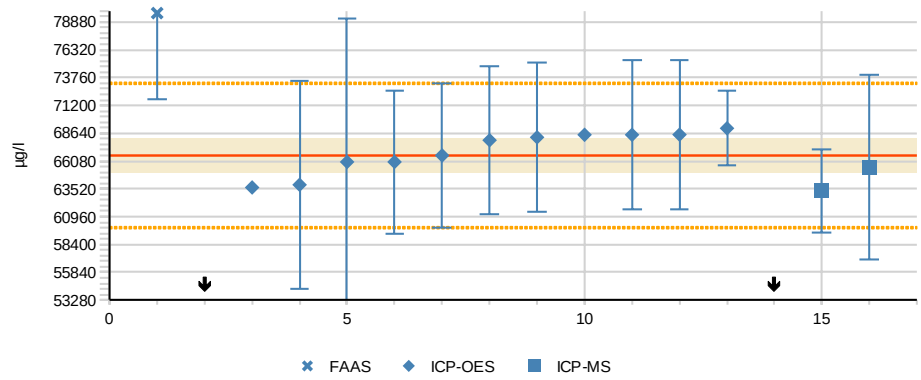
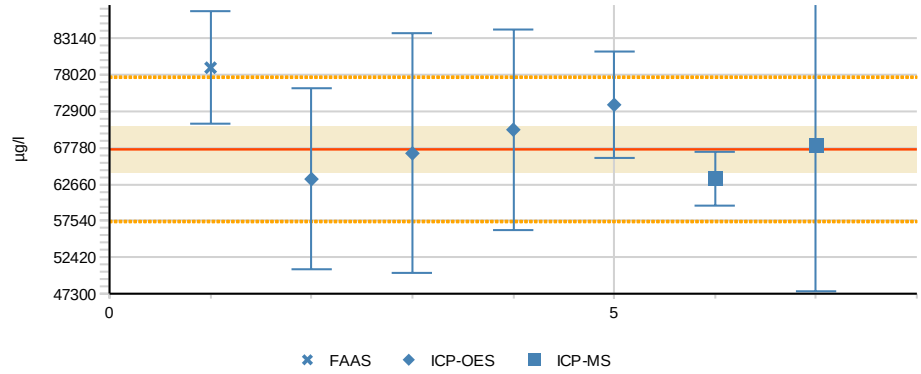
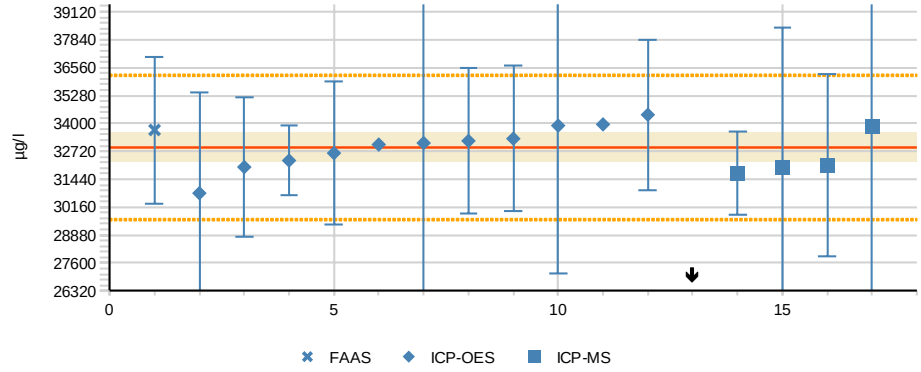


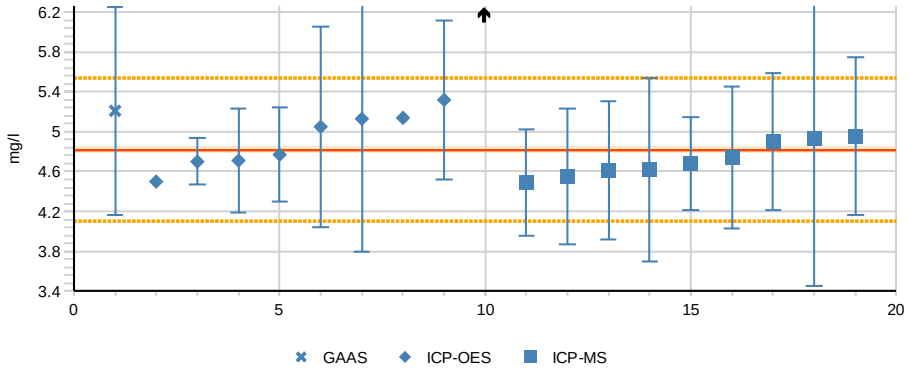
Measurand Ca Sample TY3



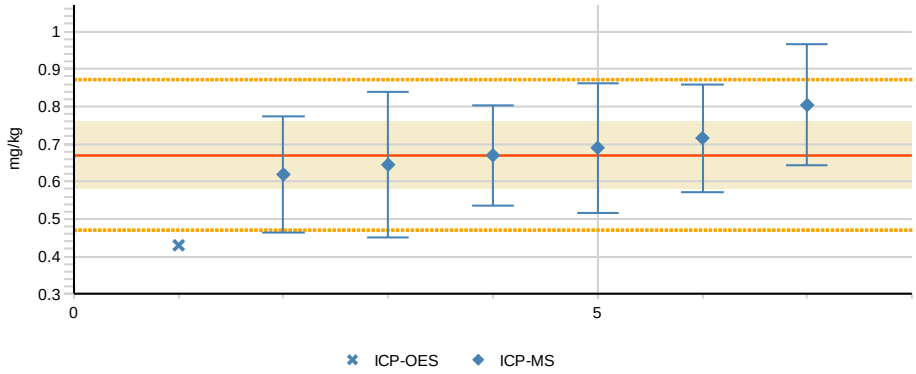
Measurand Ca Sample V2M



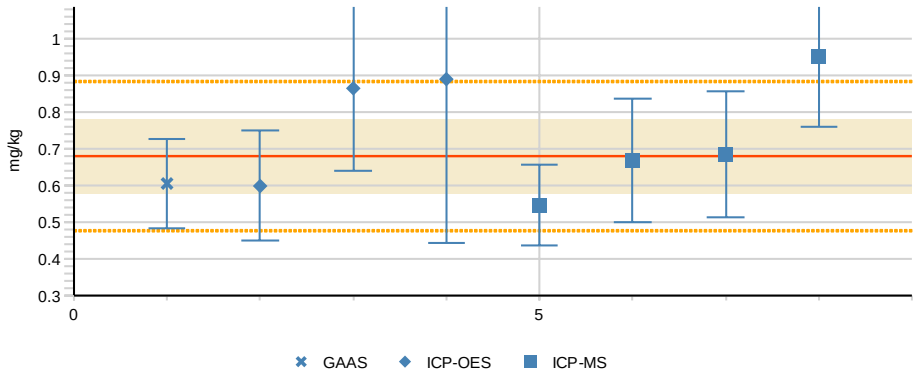
Measurand Cd Sample A1M



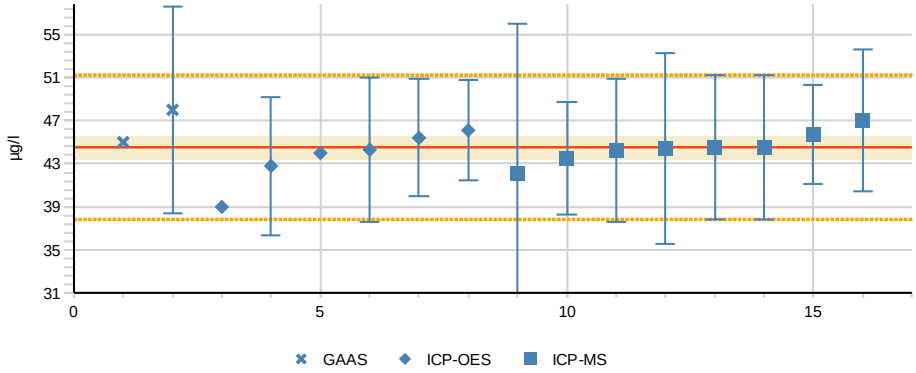
Measurand Cd Sample LN4



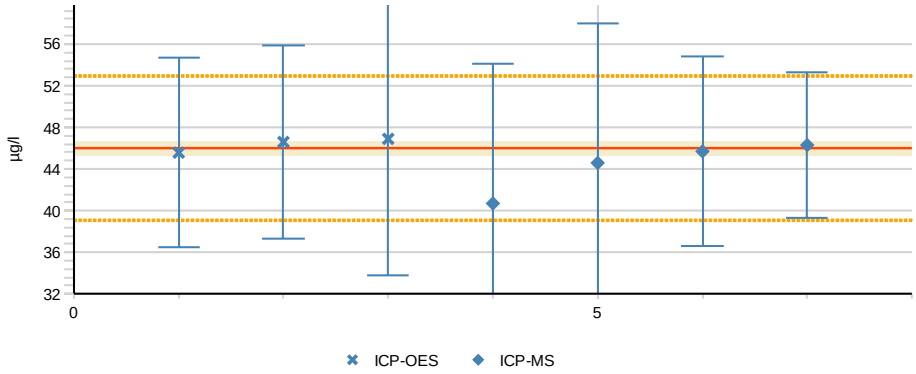
Measurand Cd Sample LO4



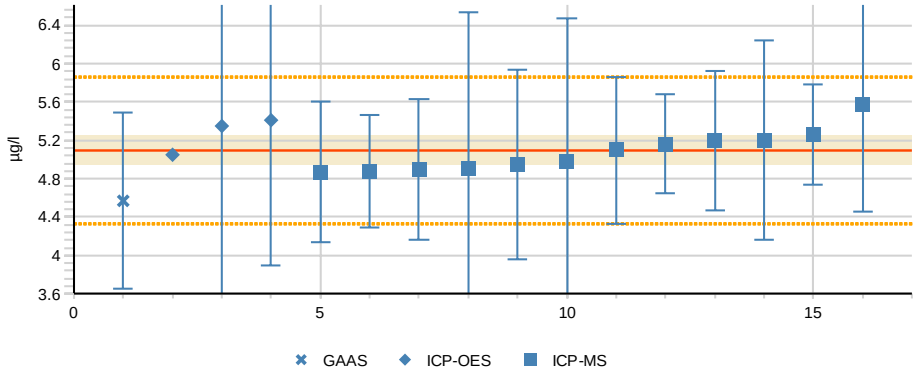
Measurand Cd Sample TN3



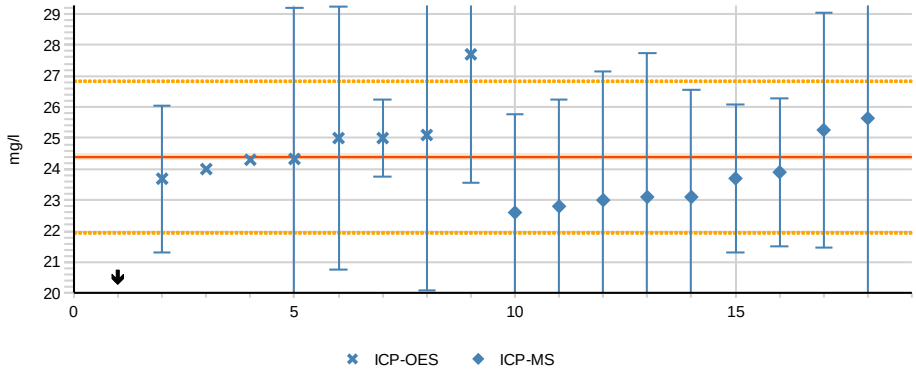
Measurand Cd Sample TY3



Measurand Cd Sample V2M



Measurand Co Sample A1M



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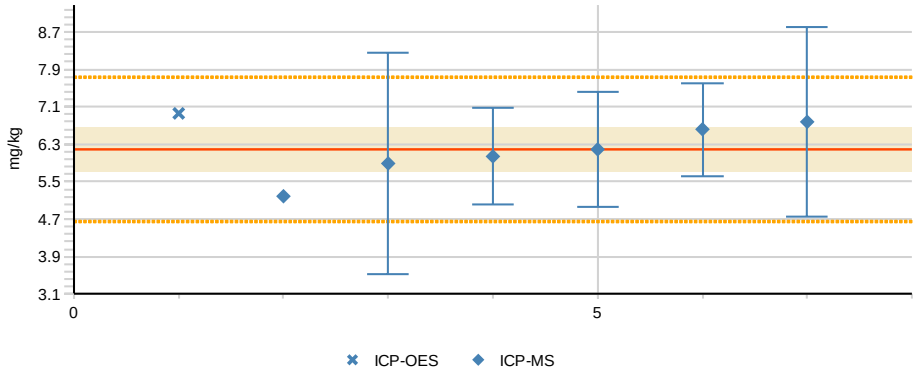

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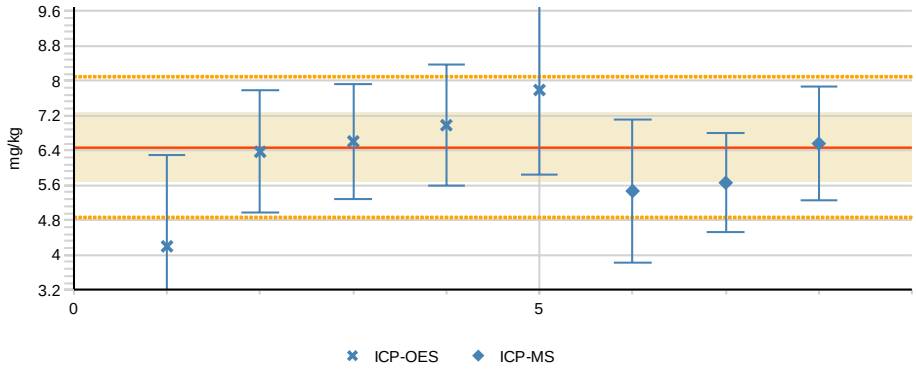
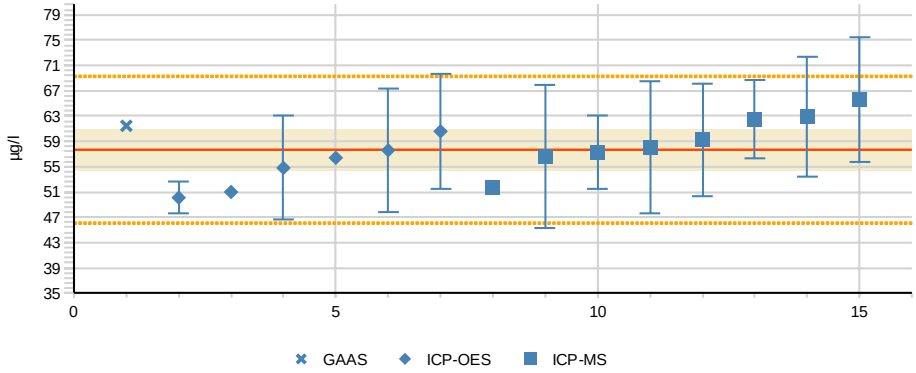
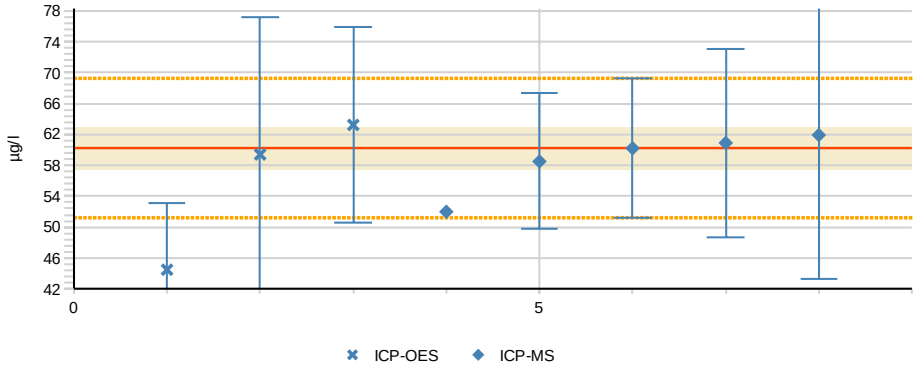


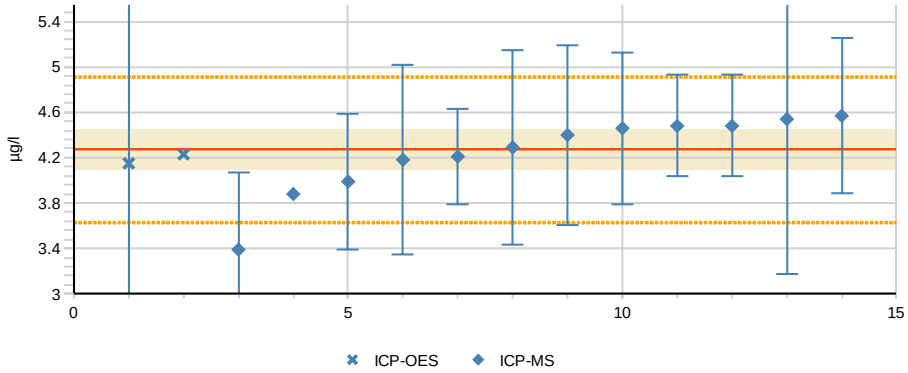
Measurand Co Sample TN3



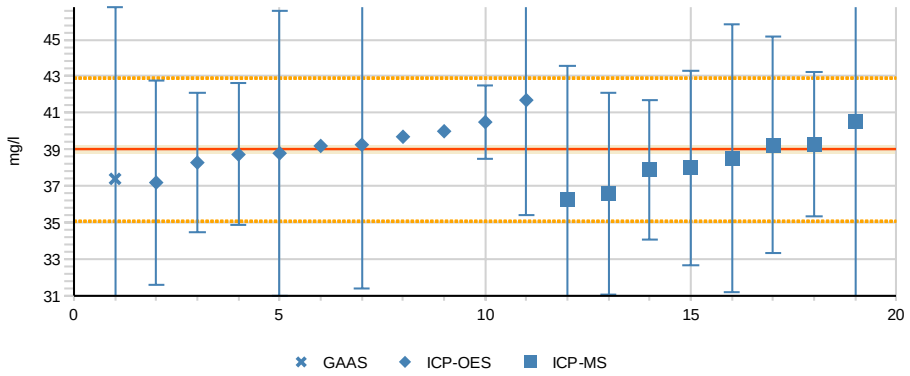
Measurand Co Sample TY3



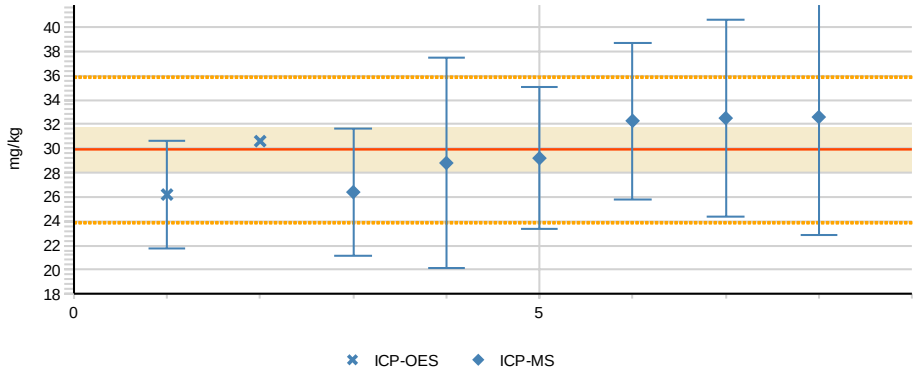
Measurand Co Sample V2M



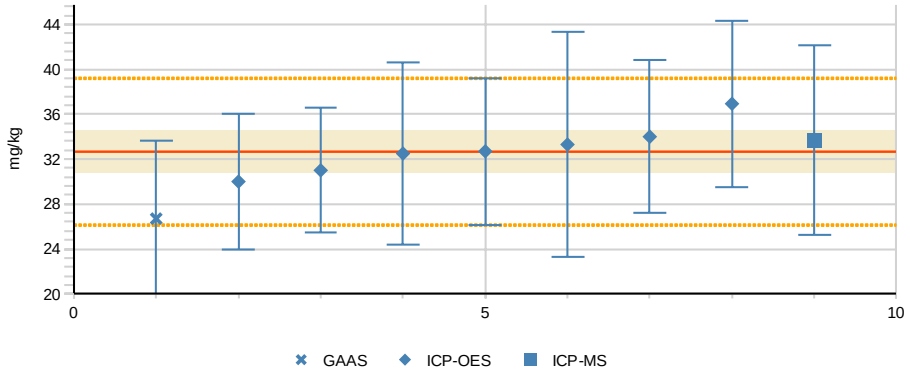
Measurand Cr Sample A1M



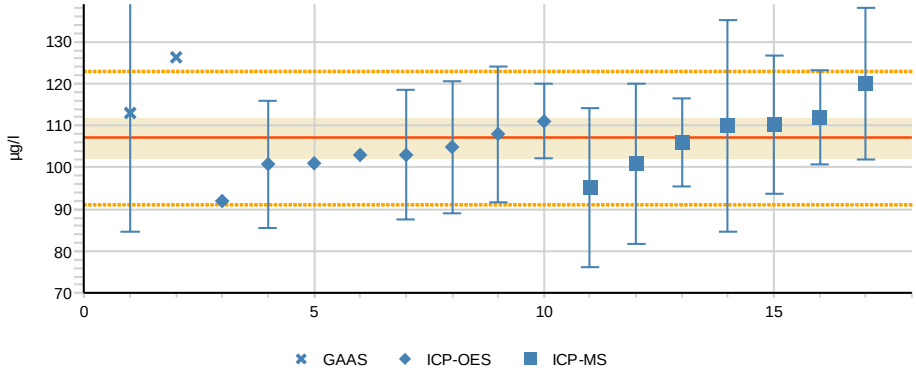
Measurand Cr Sample LN4



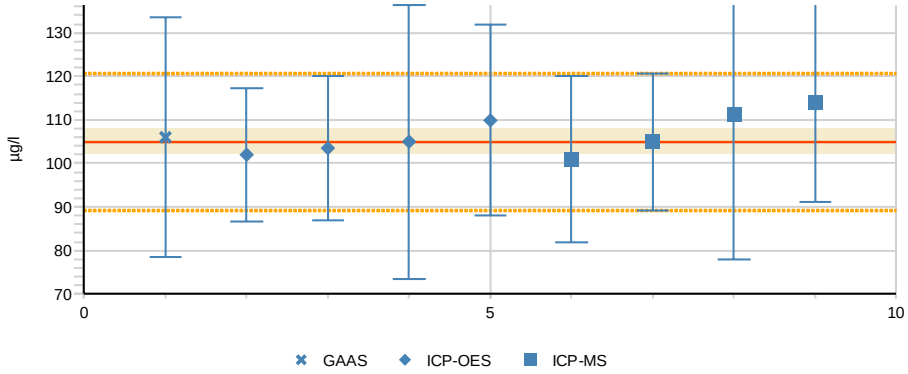
Measurand Cr Sample LO4



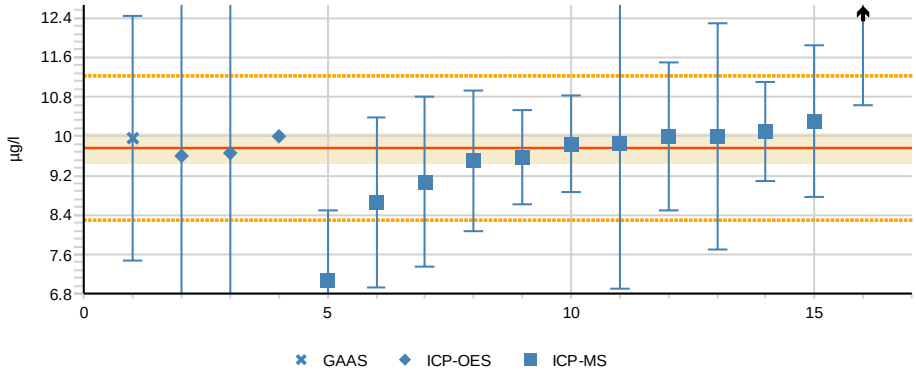
Measurand Cr Sample TN3



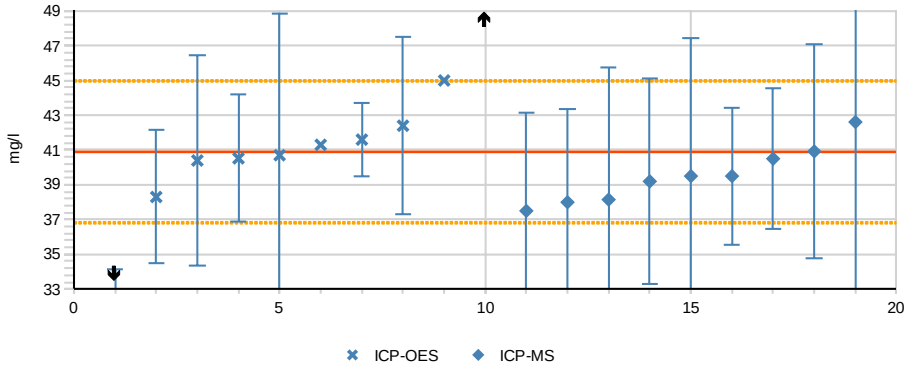
Measurand Cr Sample TY3



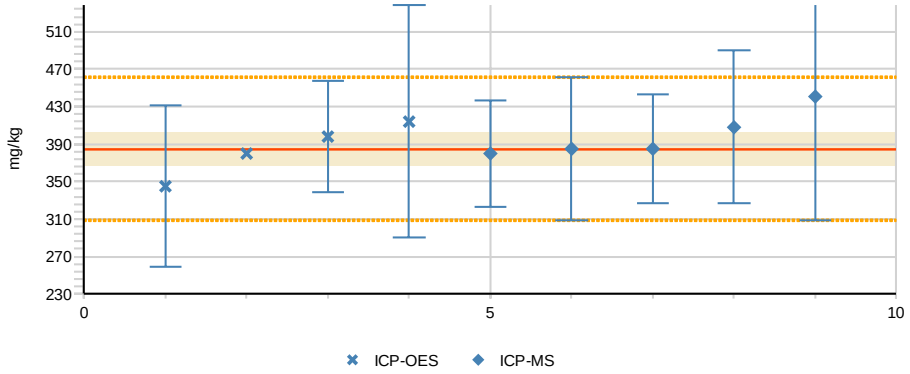
Measurand Cr Sample V2M



Measurand Cu Sample A1M



Measurand Cu Sample LN4



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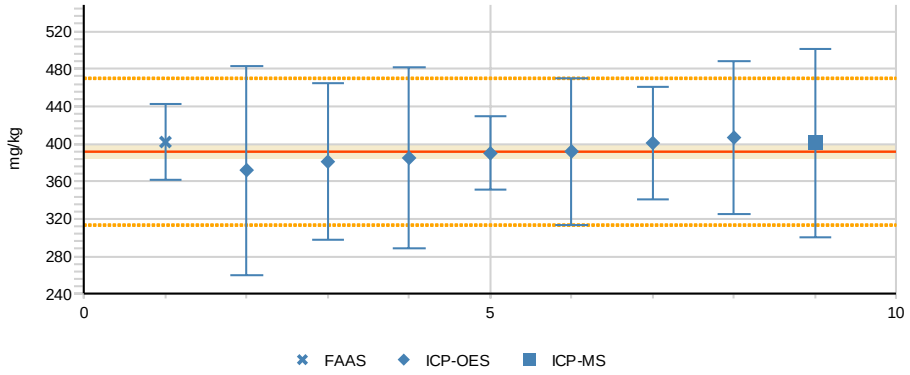
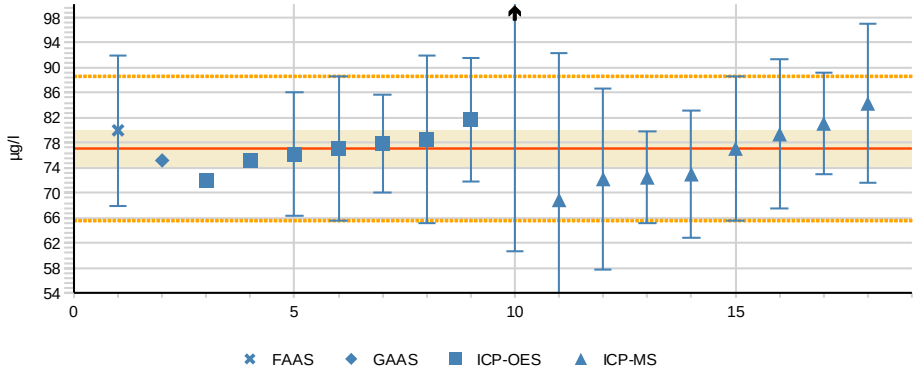
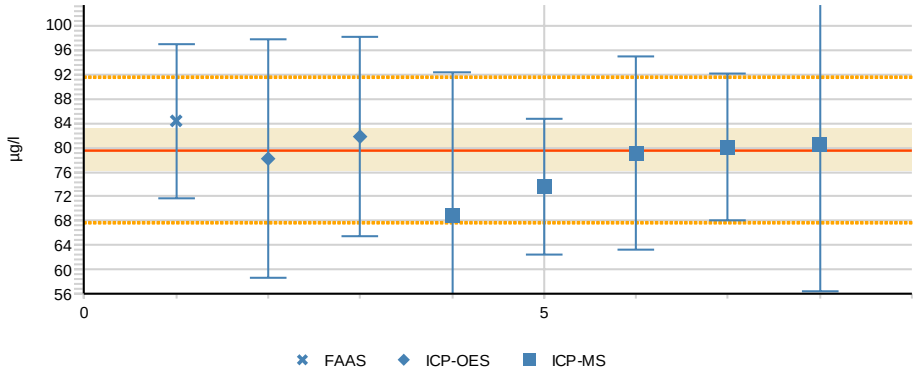


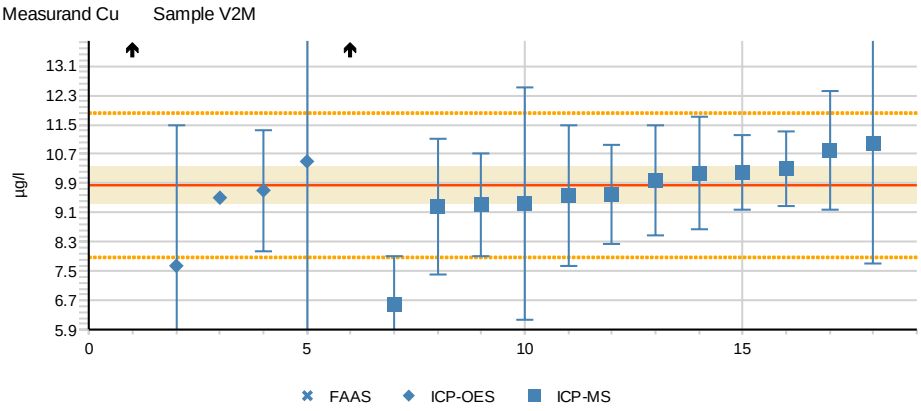
Measurand Cu Sample TN3



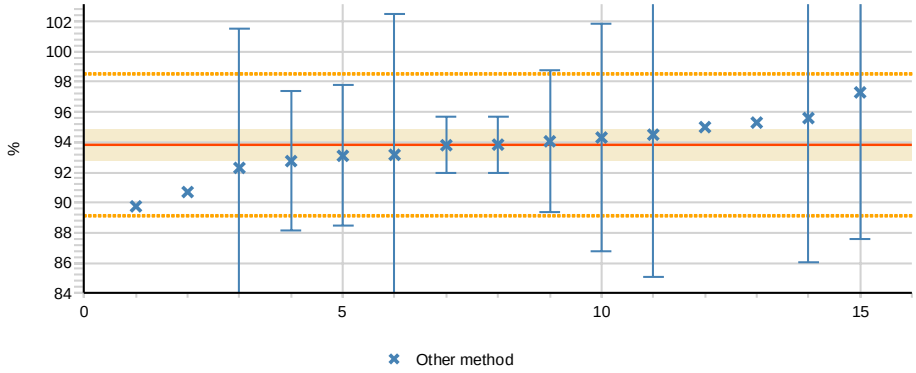
Measurand Cu Sample TY3



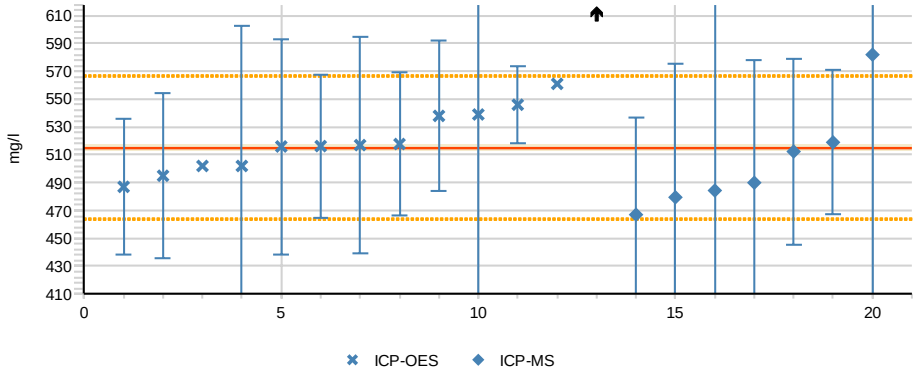
Measurand Cu Sample V2M



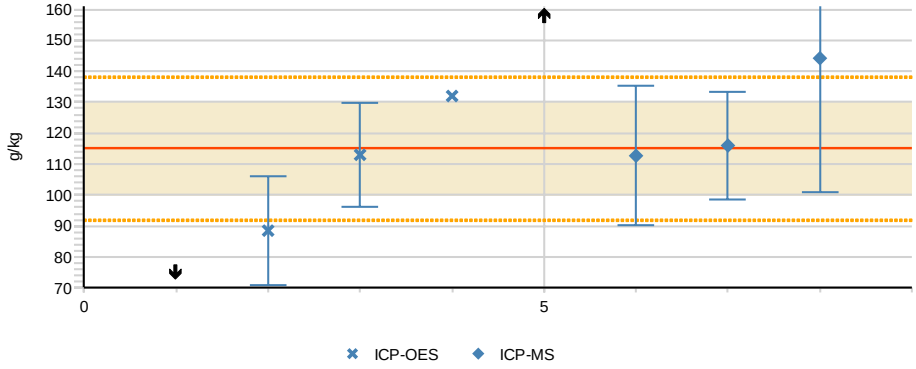
Measurand Drw Sample L4M



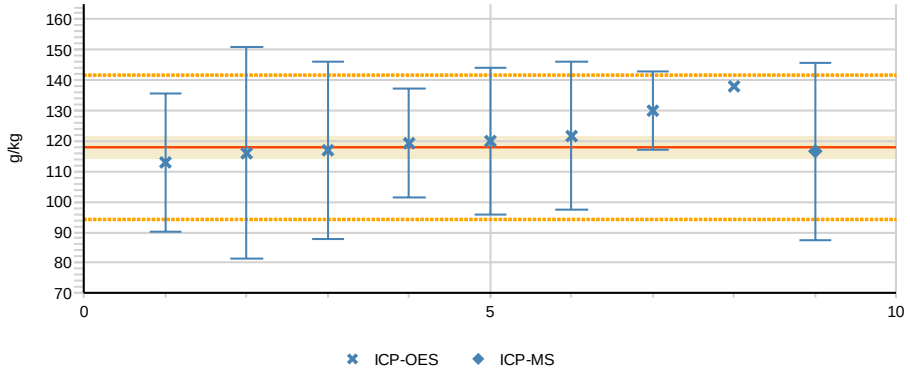
Measurand Fe Sample A1M



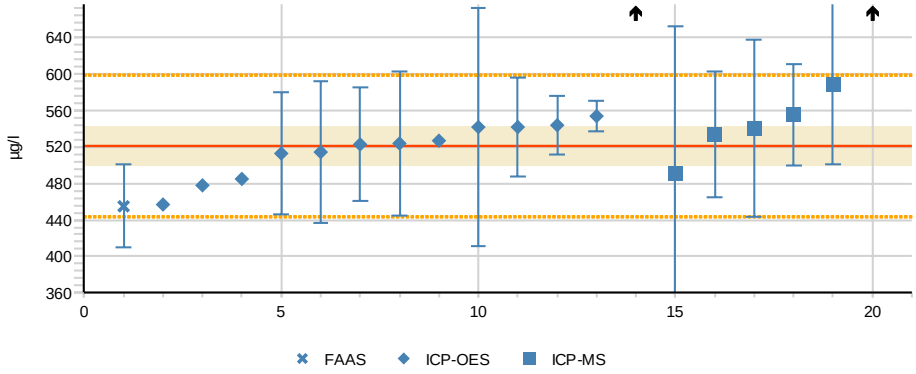
Measurand Fe Sample LN4



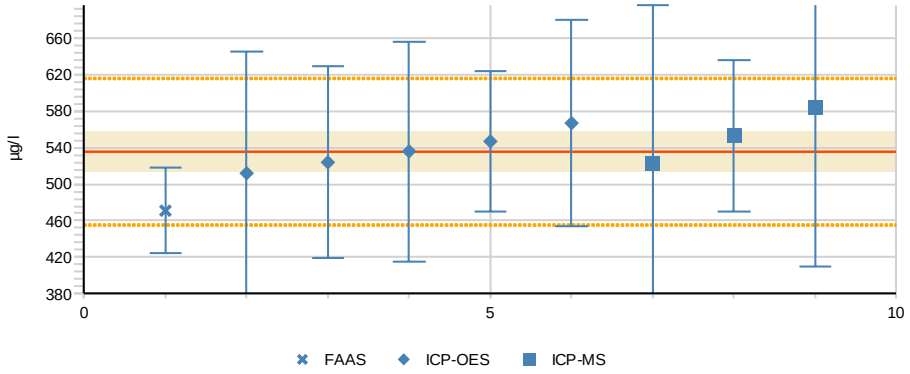
Measurand Fe Sample LO4



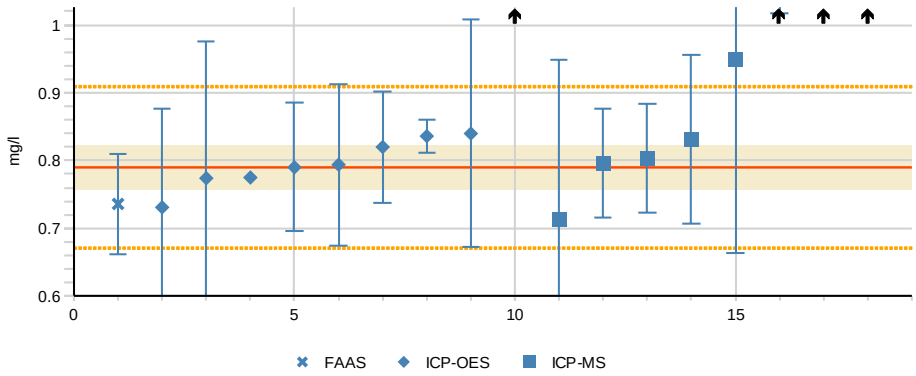
Measurand Fe Sample TN3



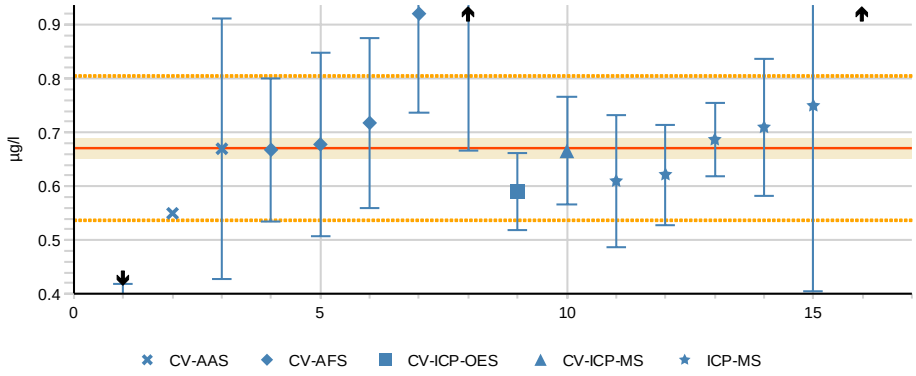
Measurand Fe Sample TY3



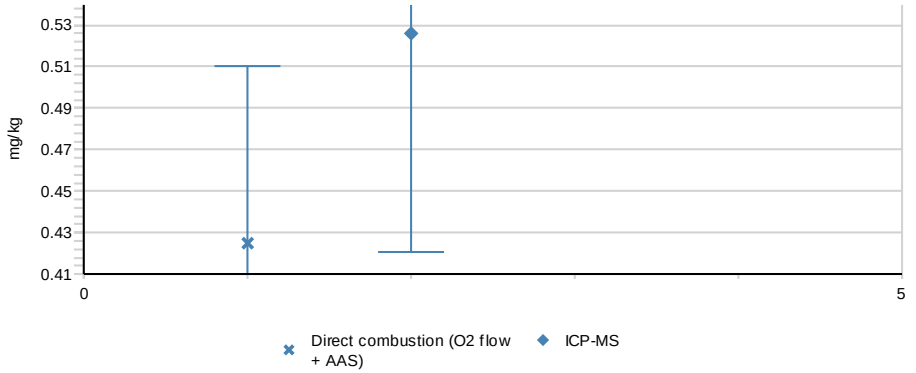
Measurand Fe Sample V2M



Measurand Hg Sample A1Hg



Measurand Hg Sample LC4



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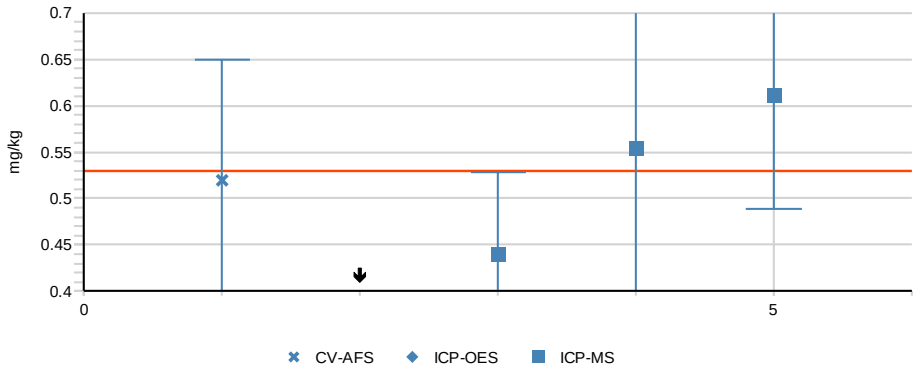
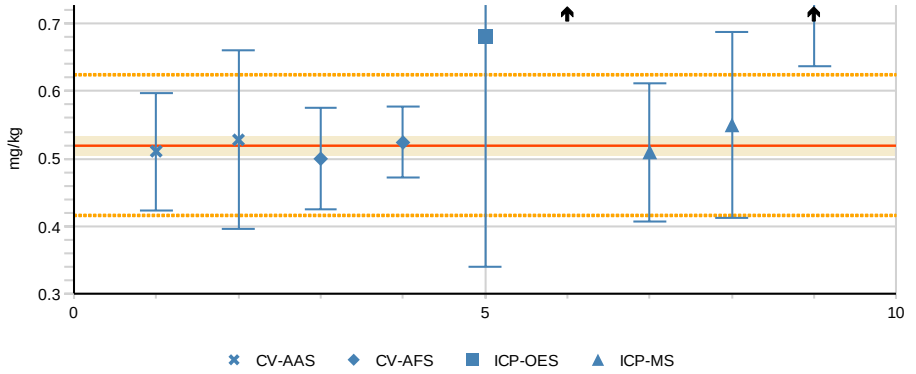
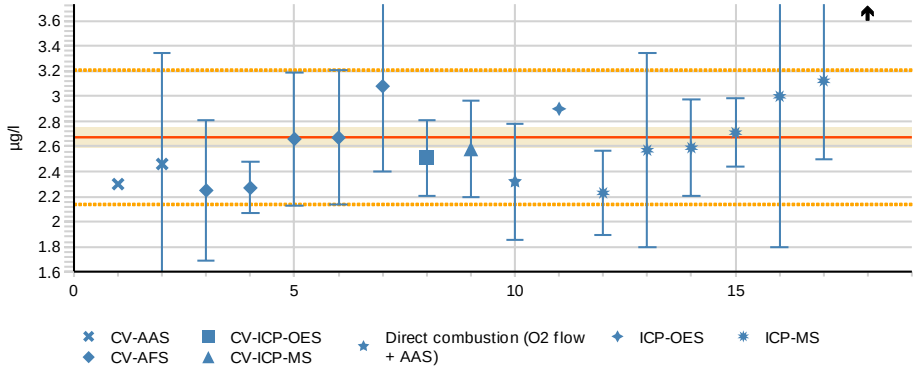


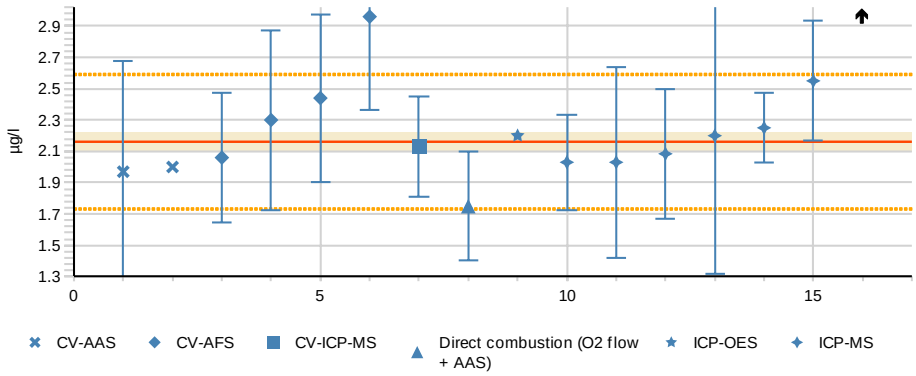
Measurand Hg Sample LO4



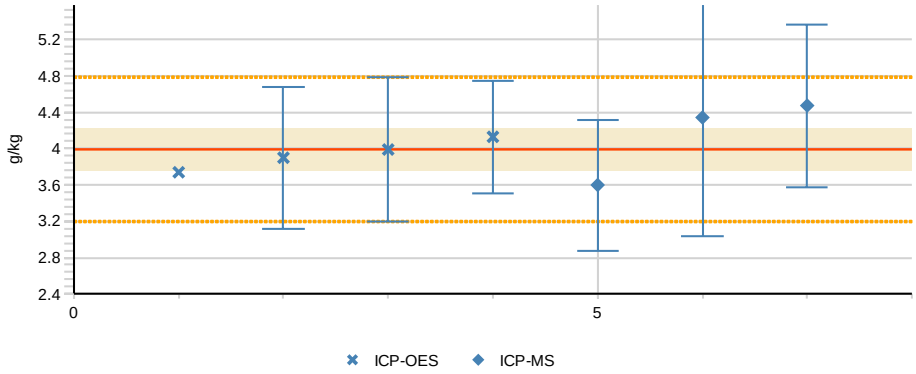
Measurand Hg Sample T3Hg



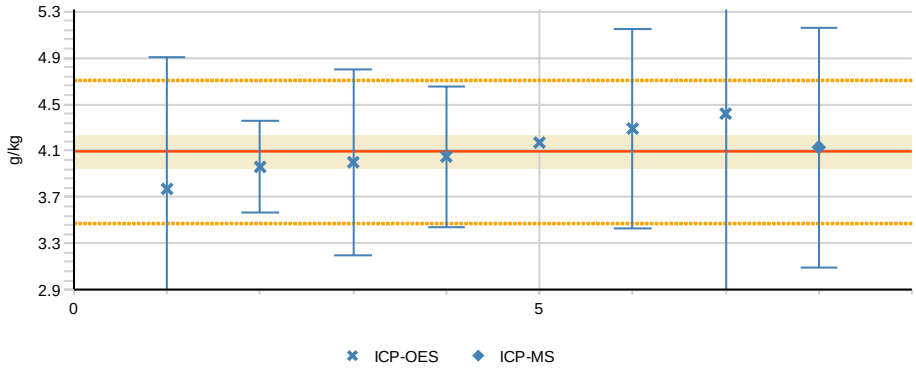
Measurand Hg Sample V2Hg



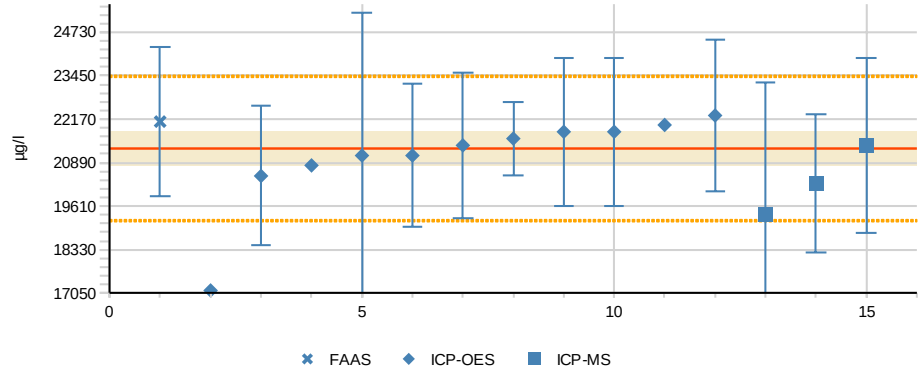
Measurand Mg Sample LN4



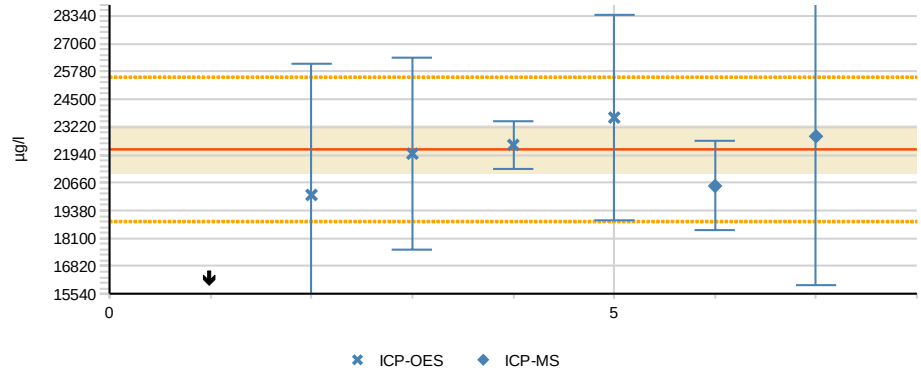
Measurand Mg Sample LO4



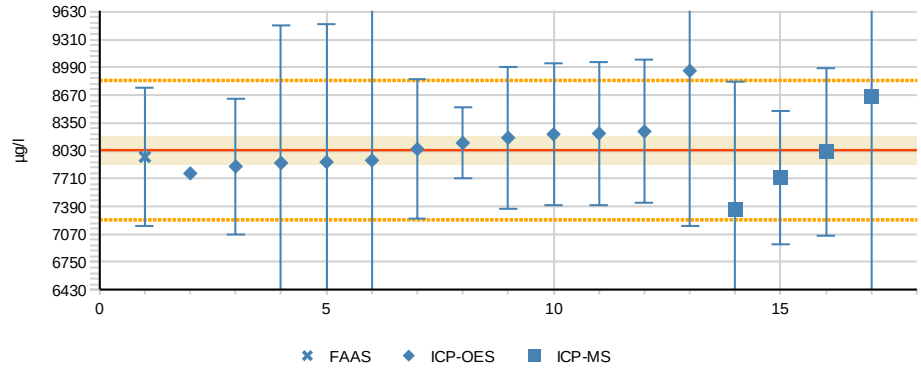
Measurand Mg Sample TN3



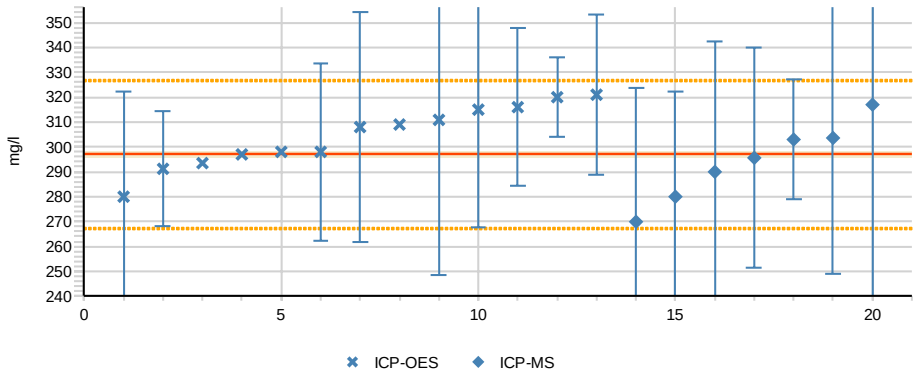
Measurand Mg Sample TY3



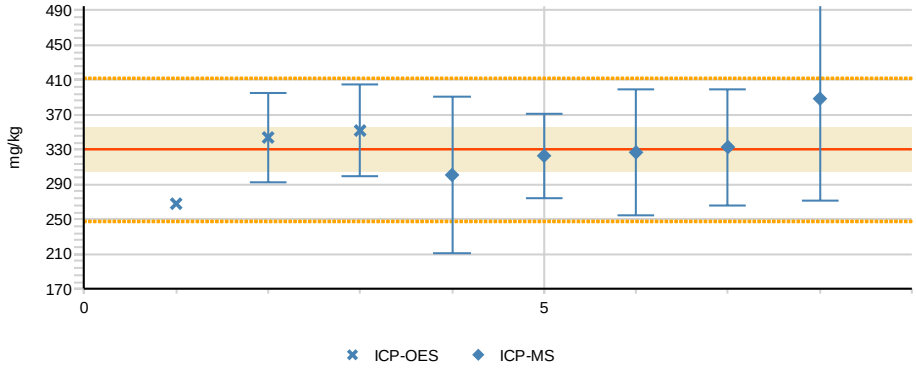
Measurand Mg Sample V2M



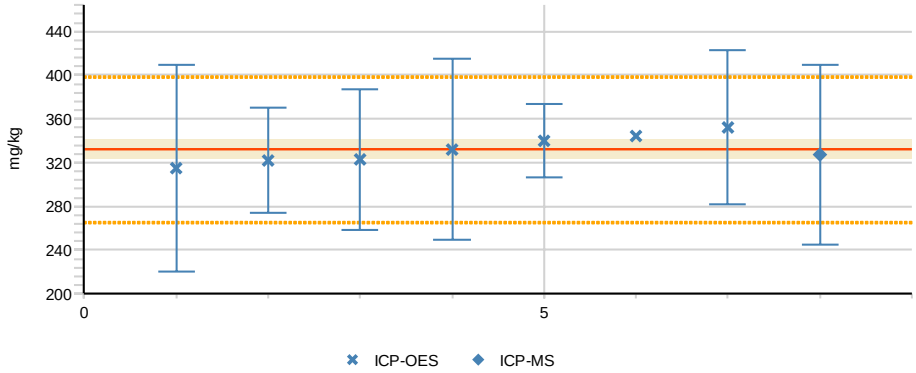
Measurand Mn Sample A1M



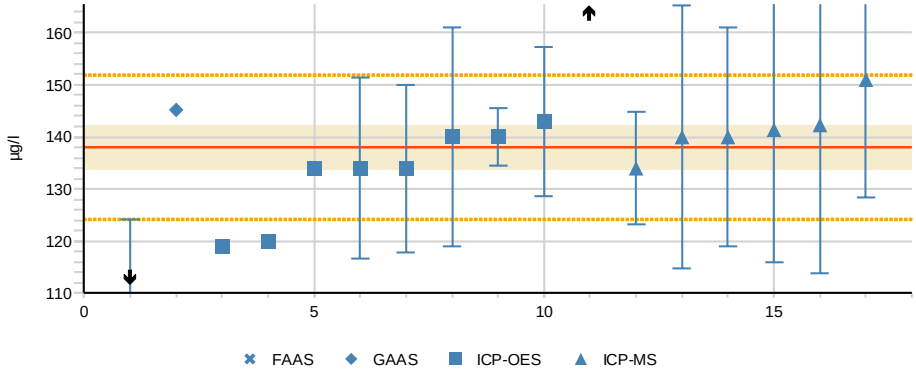
Measurand Mn Sample LN4



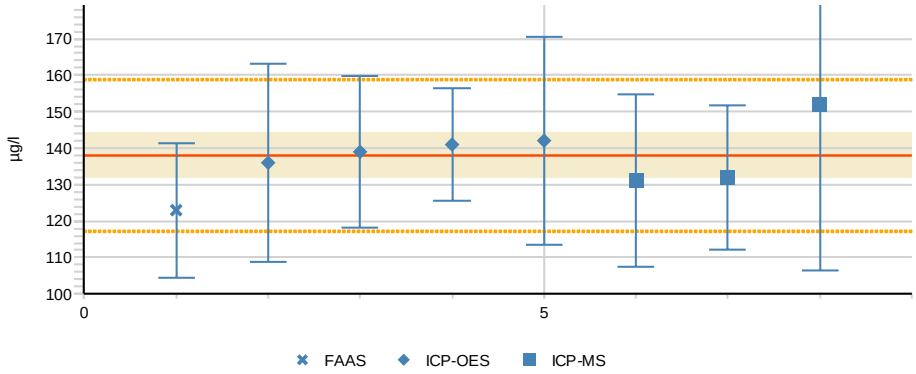
Measurand Mn Sample LO4



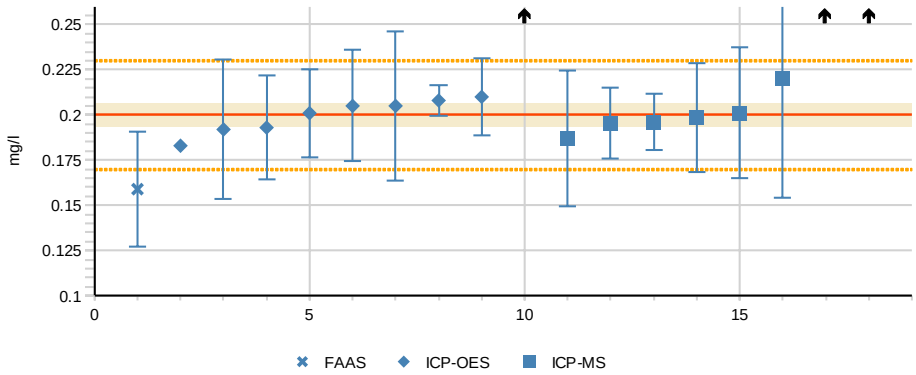
Measurand Mn Sample TN3



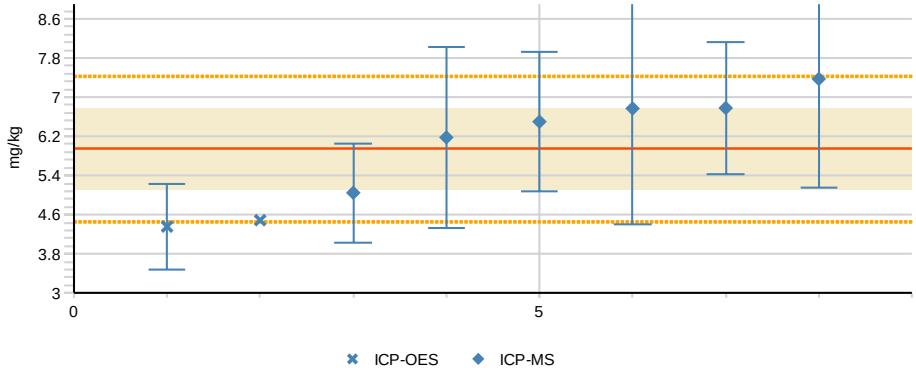
Measurand Mn Sample TY3



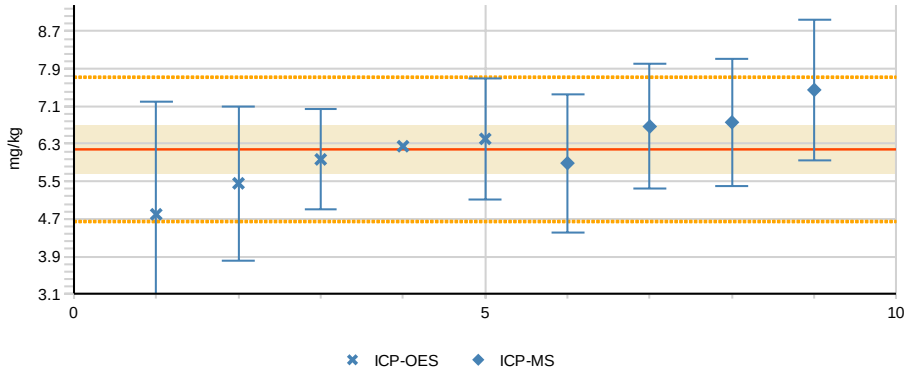
Measurand Mn Sample V2M



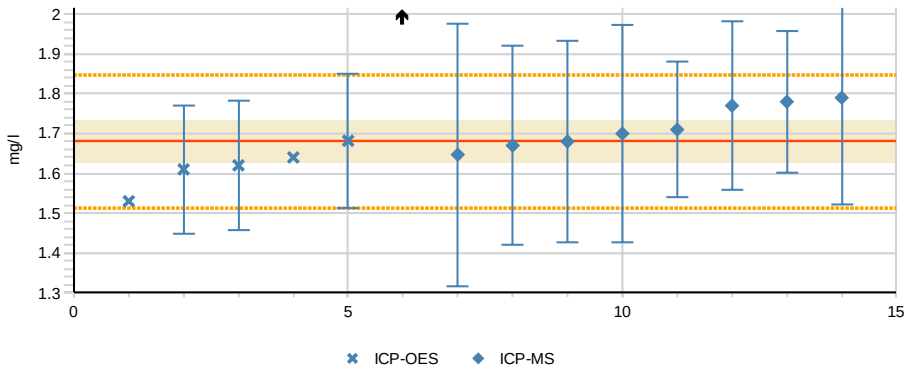
Measurand Mo Sample LN4



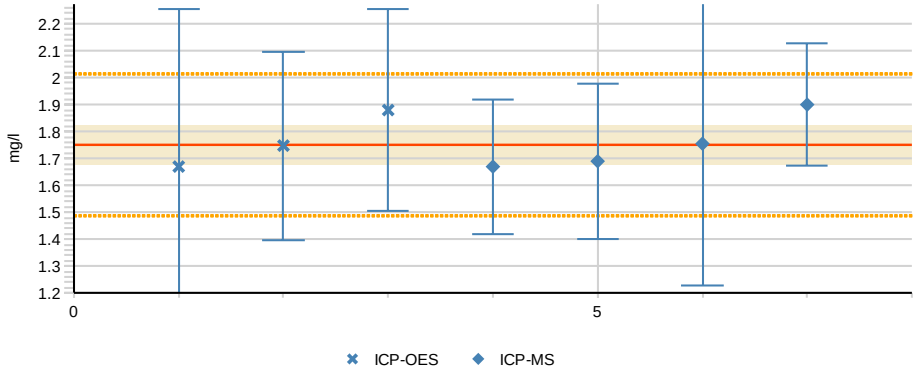
Measurand Mo Sample LO4



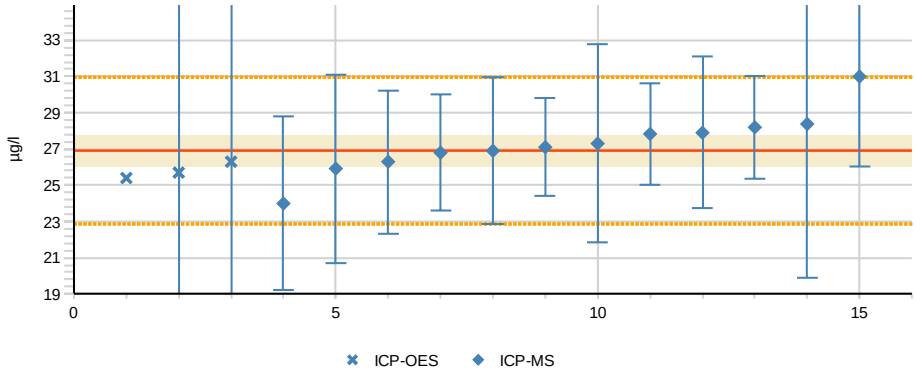
Measurand Mo Sample TN3



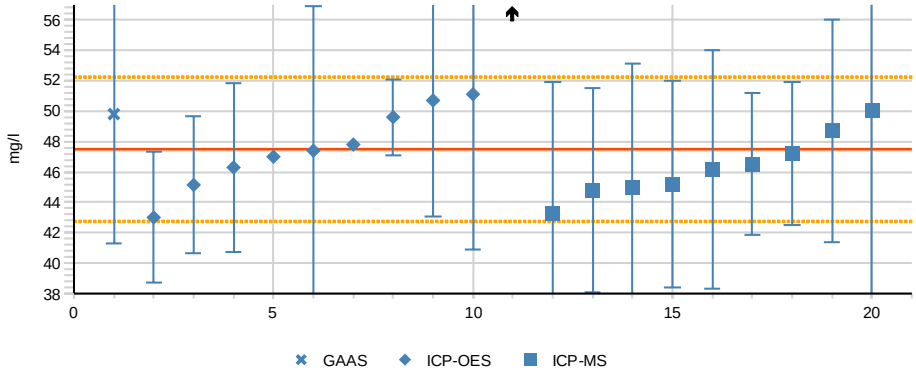
Measurand Mo Sample TY3



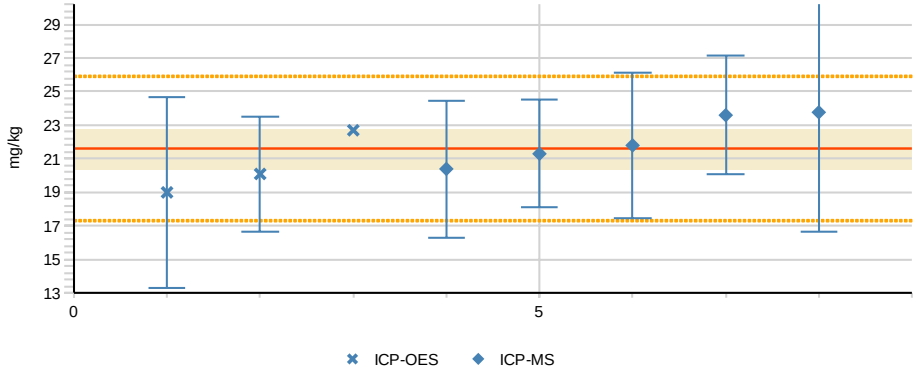
Measurand Mo Sample V2M



Measurand Ni Sample A1M



Measurand Ni Sample LN4



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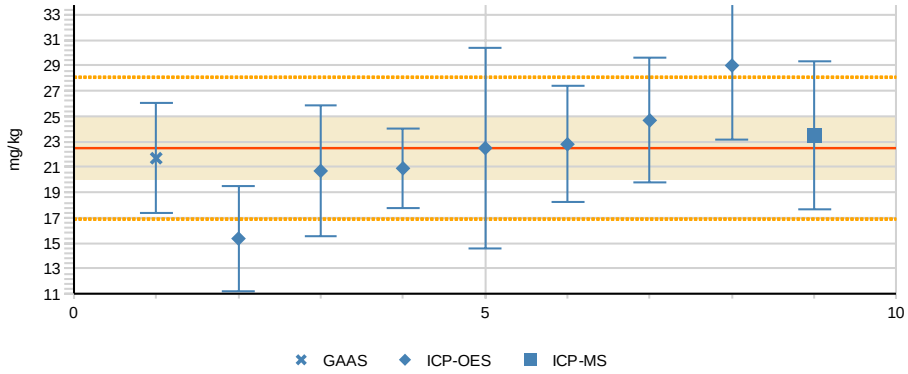
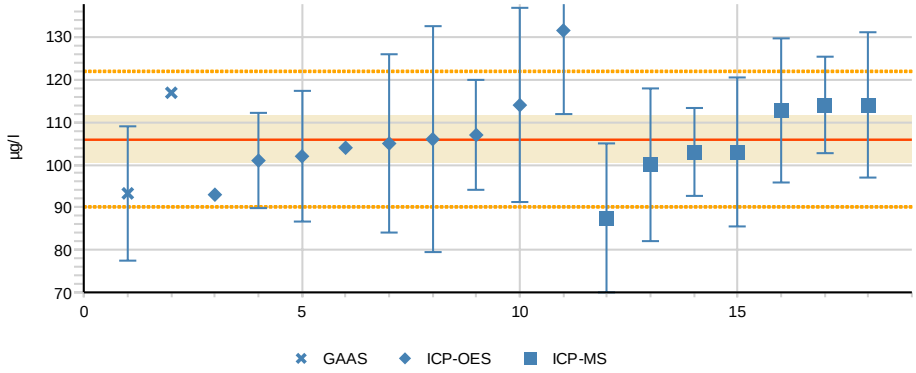
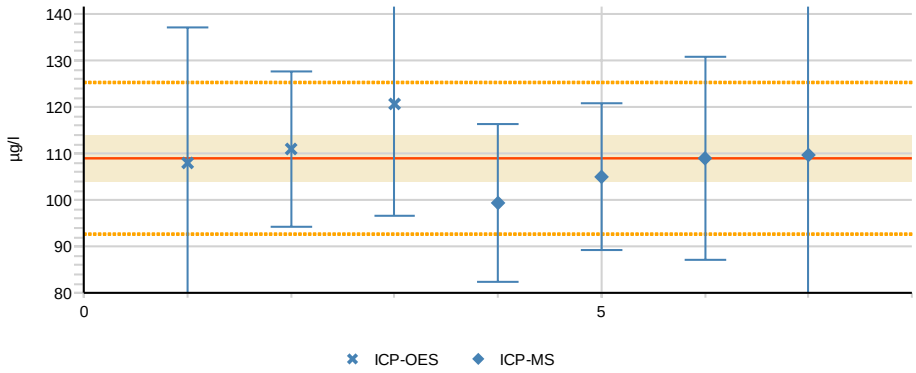


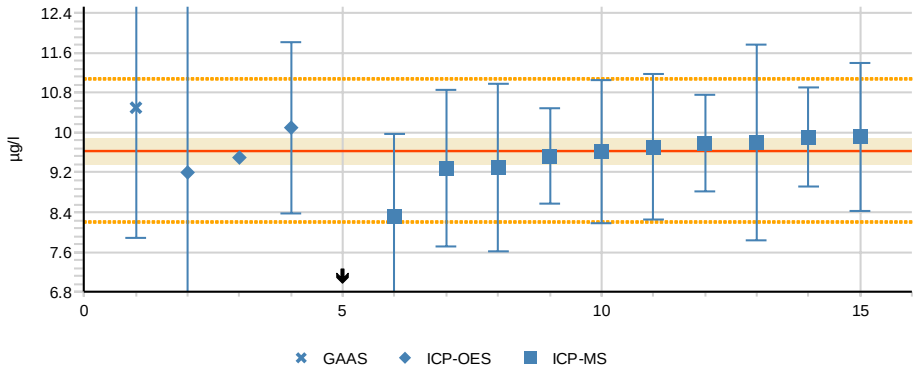
Measurand Ni Sample TN3



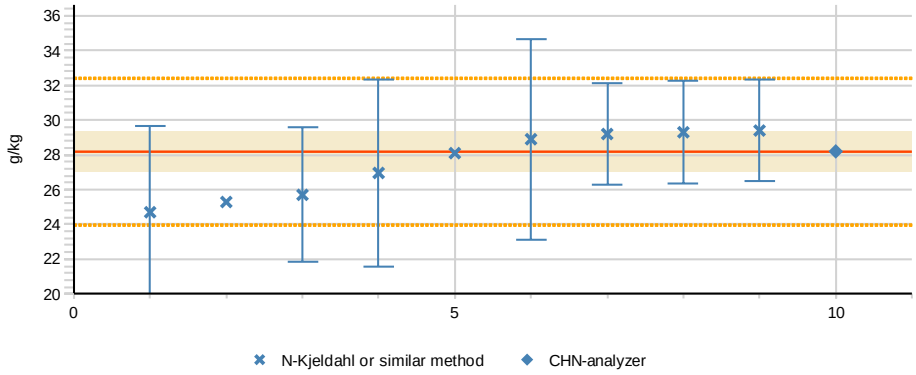
Measurand Ni Sample TY3



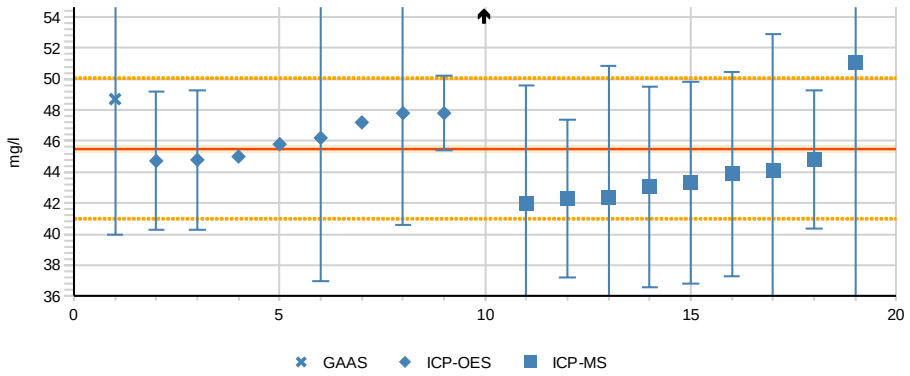
Measurand Ni Sample V2M



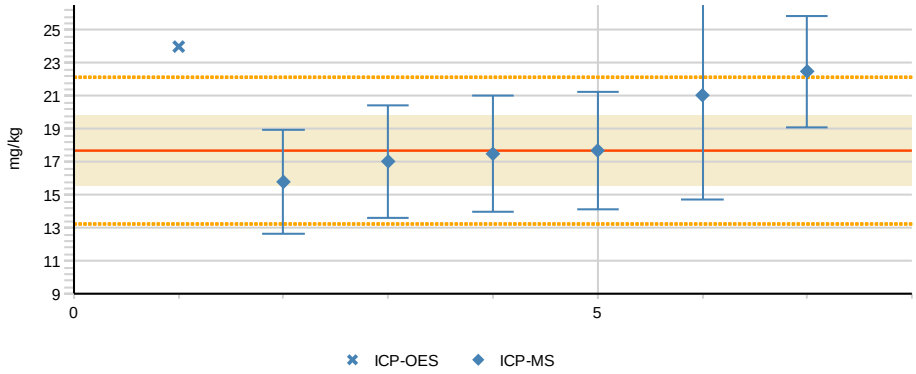
Measurand N_{tot} Sample L4M



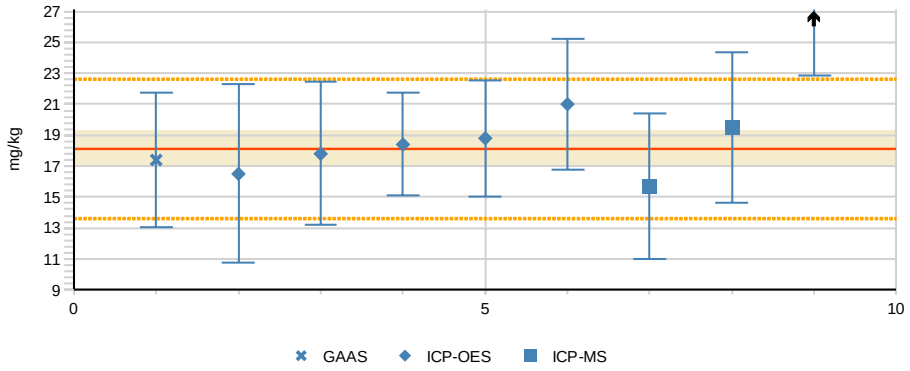
Measurand Pb Sample A1M



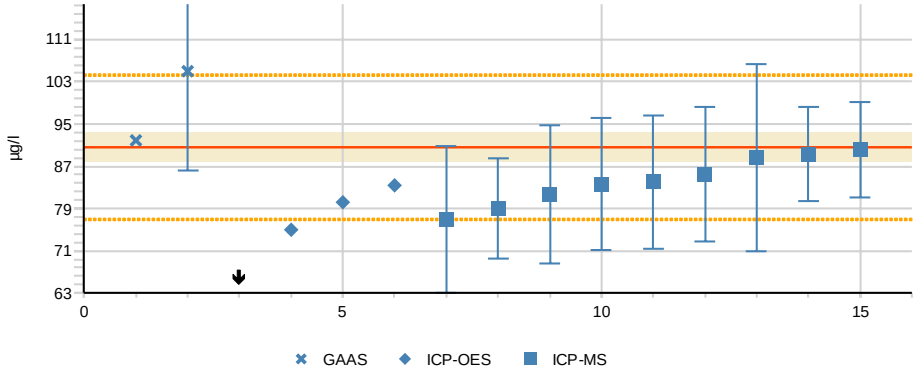
Measurand Pb Sample LN4



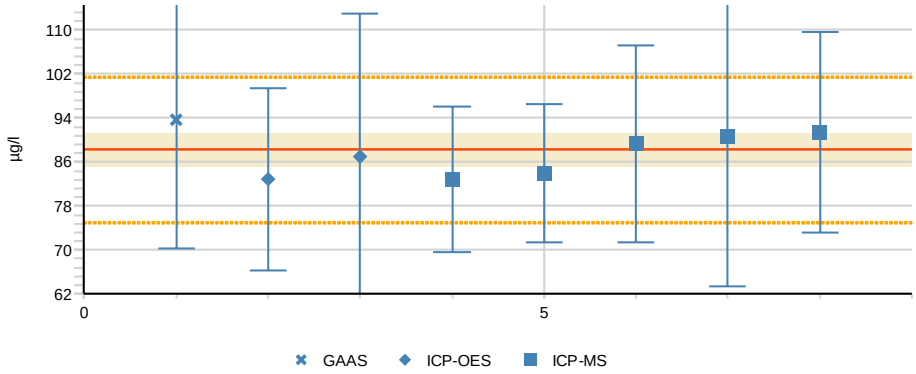
Measurand Pb Sample LO4



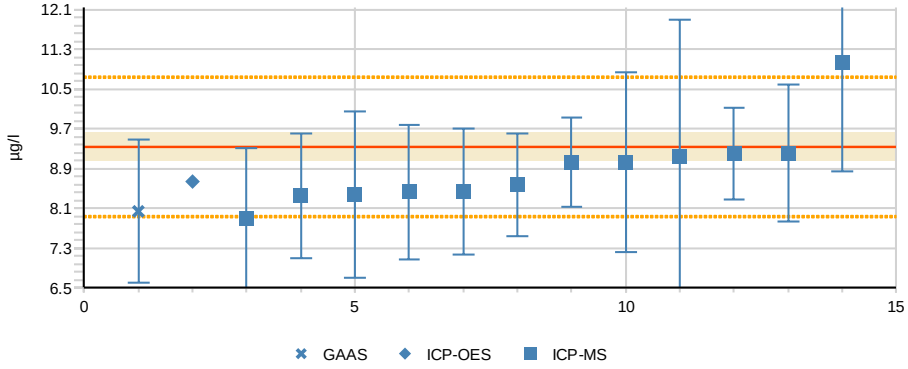
Measurand Pb Sample TN3

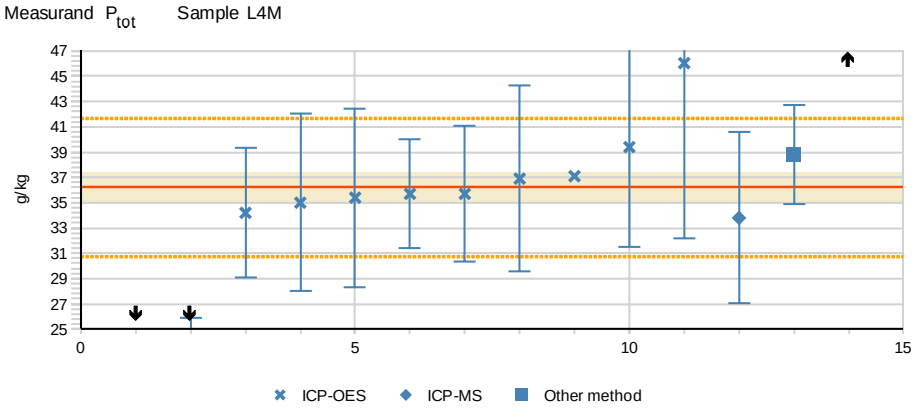


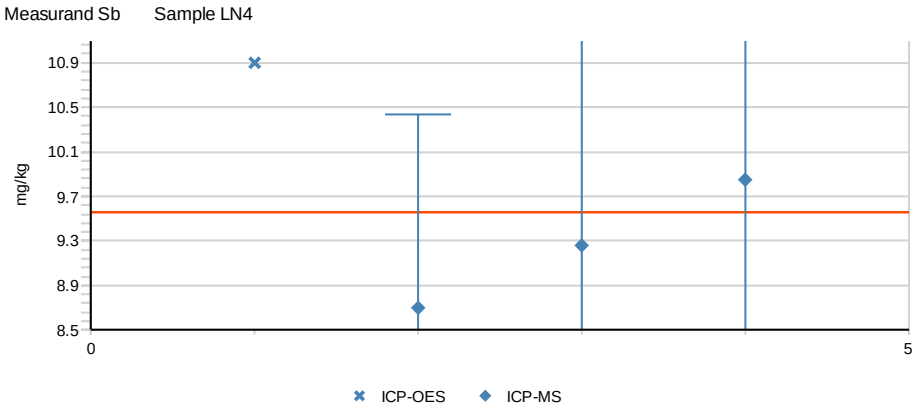
Measurand Pb Sample TY3

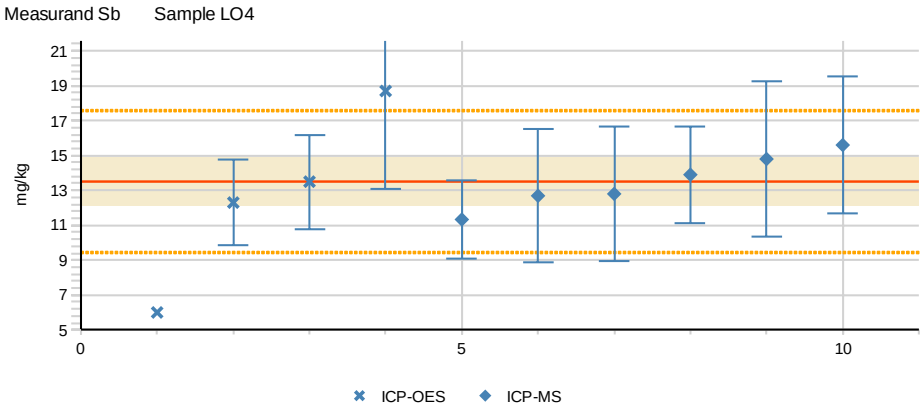


Measurand Pb Sample V2M

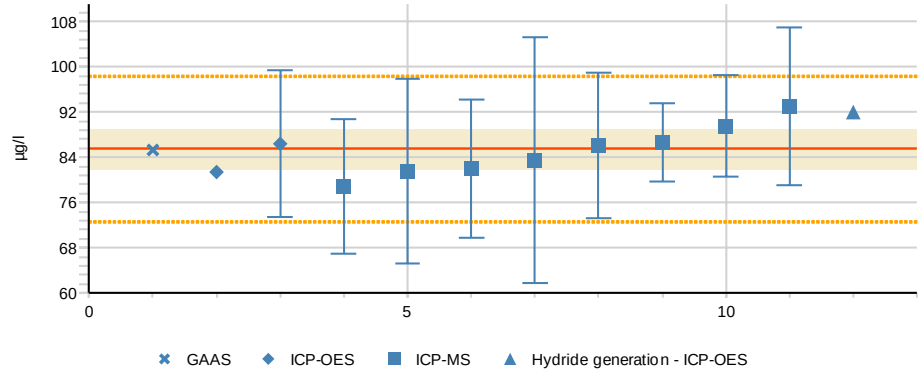



Measurand P_{tot} Sample L4M
g/kg
47
45
43
41
39
37
35
33
31
29
27
25
0
5
10
15
ICP-OES
ICP-MS
Other method

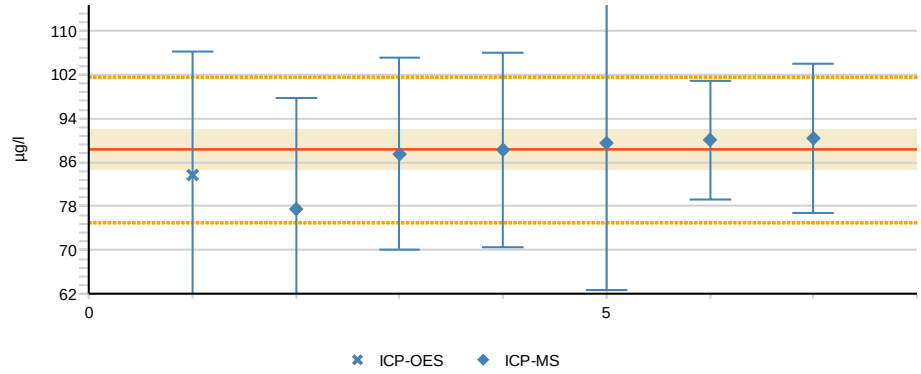

Measurand Sb Sample LN4
mg/kg
10.9
10.5
10.1
9.7
9.3
8.9
8.5
0
5
ICP-OES
ICP-MS


Measurand Sb Sample LO4
mg/kg
21
19
17
15
13
11
9
7
5
0
5
10
ICP-OES
ICP-MS

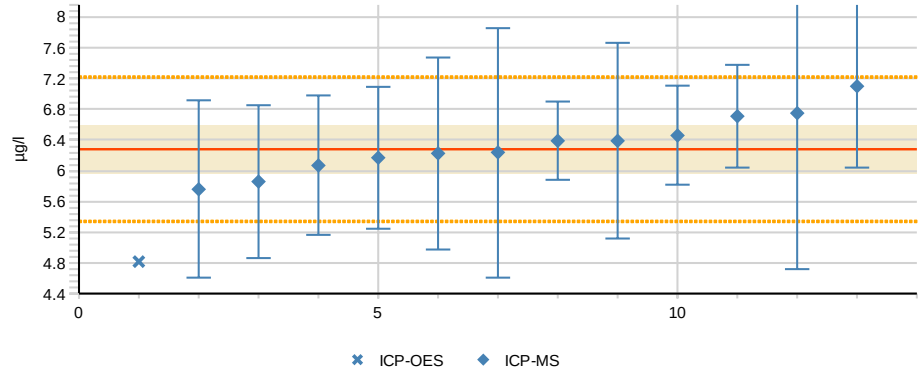
Measurand Sb Sample TN3



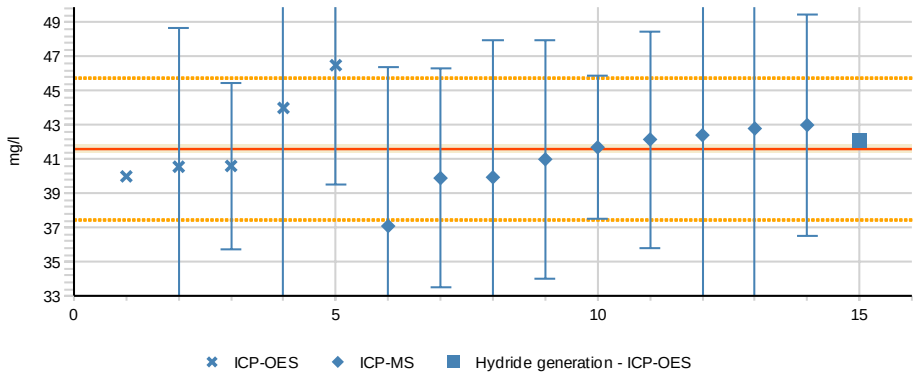
Measurand Sb Sample TY3



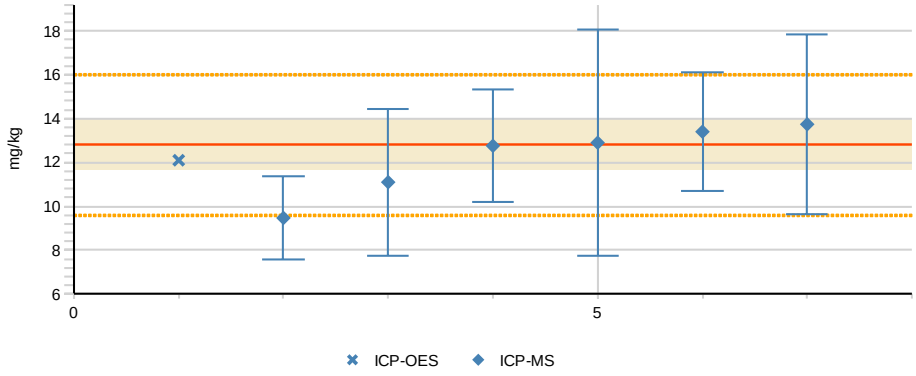
Measurand Sb Sample V2M



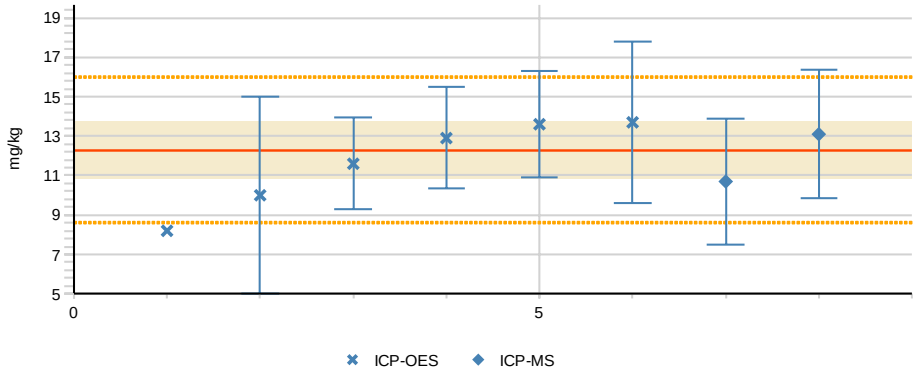
Measurand Se Sample A1M



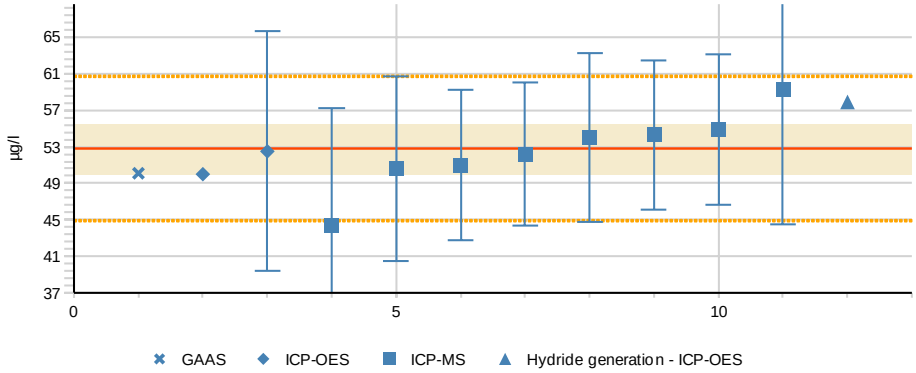
Measurand Se Sample LN4



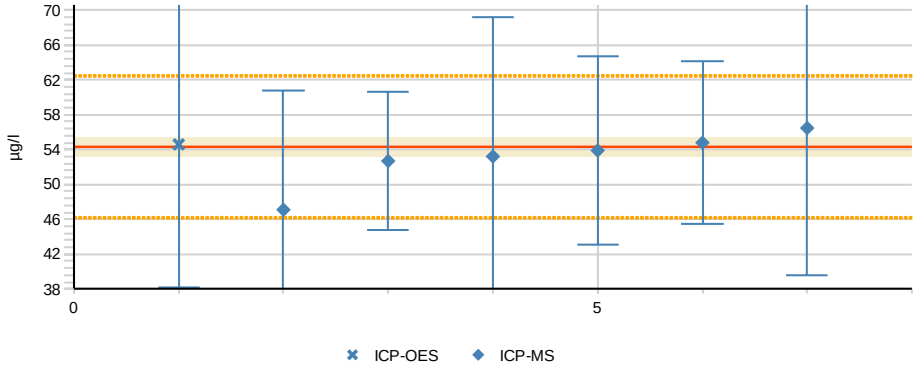
Measurand Se Sample LO4



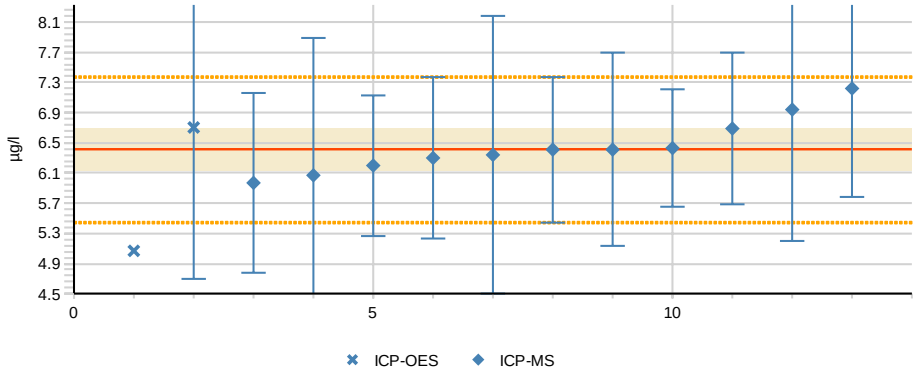
Measurand Se Sample TN3



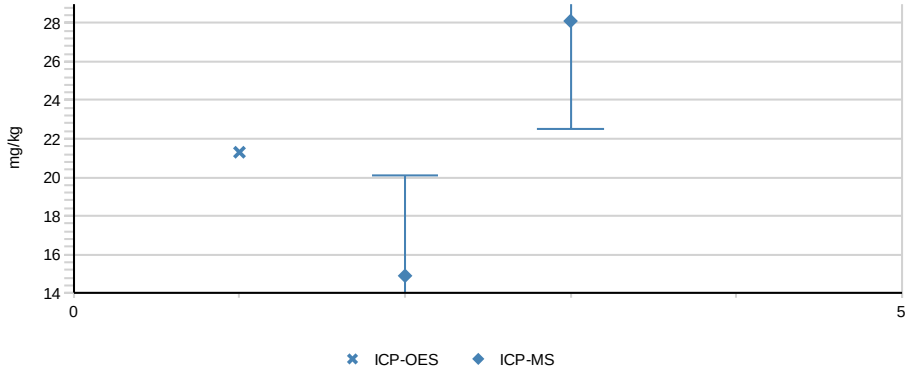
Measurand Se Sample TY3



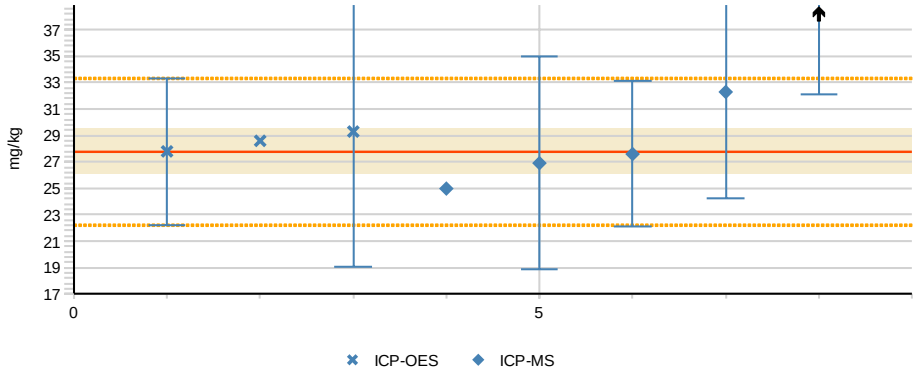
Measurand Se Sample V2M



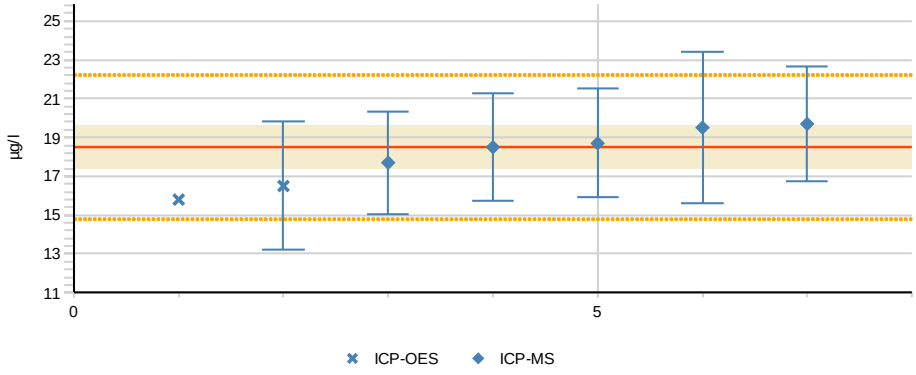
Measurand Sn Sample LN4



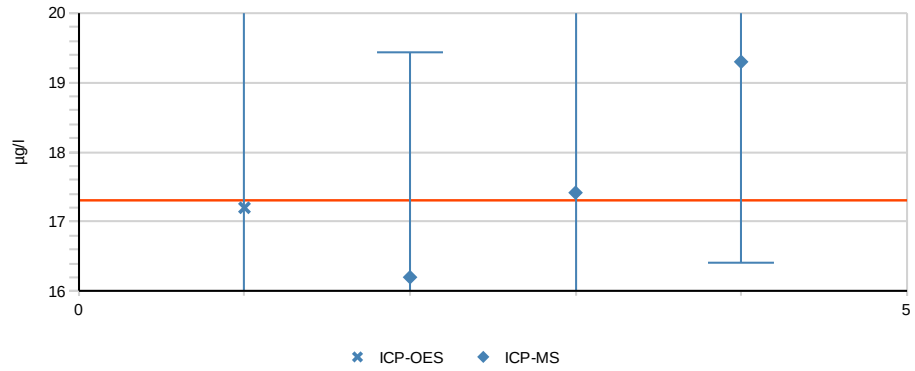
Measurand Sn Sample LO4



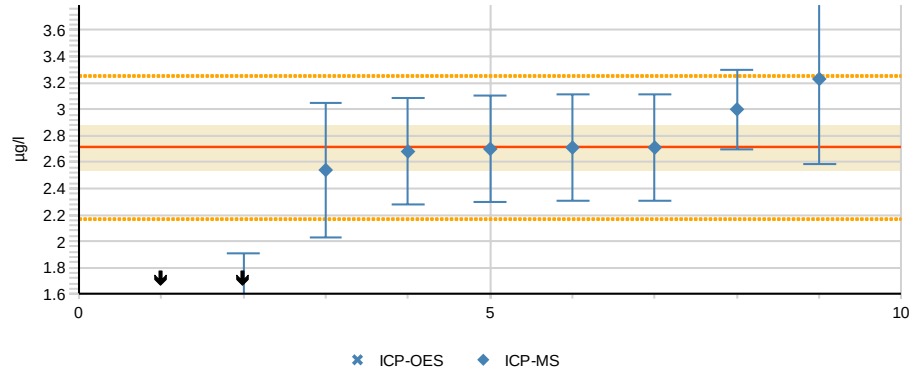
Measurand Sn Sample TN3



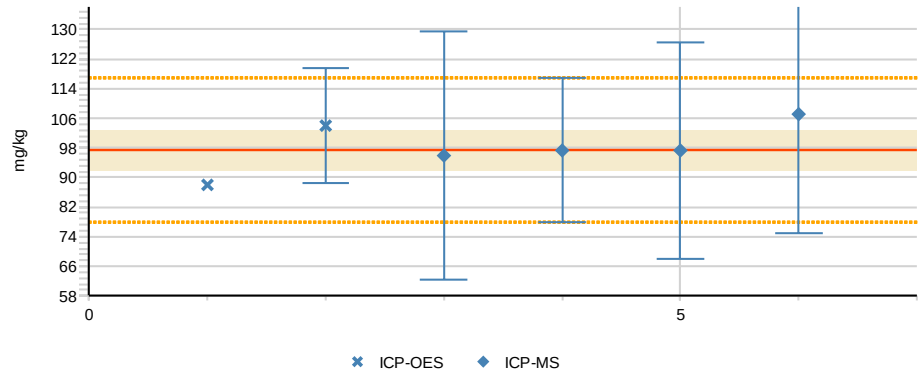
Measurand Sn Sample TY3



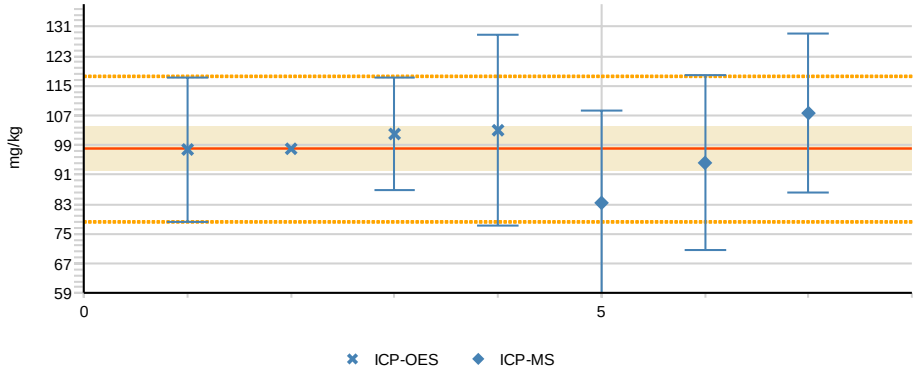
Measurand Sn Sample V2M



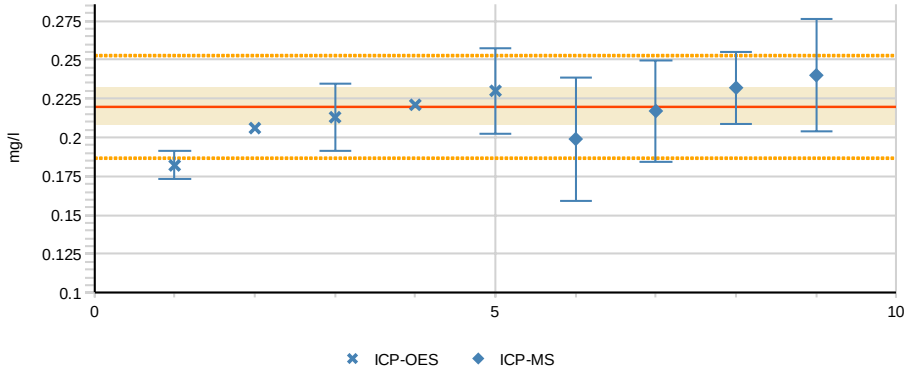
Measurand Sr Sample LN4



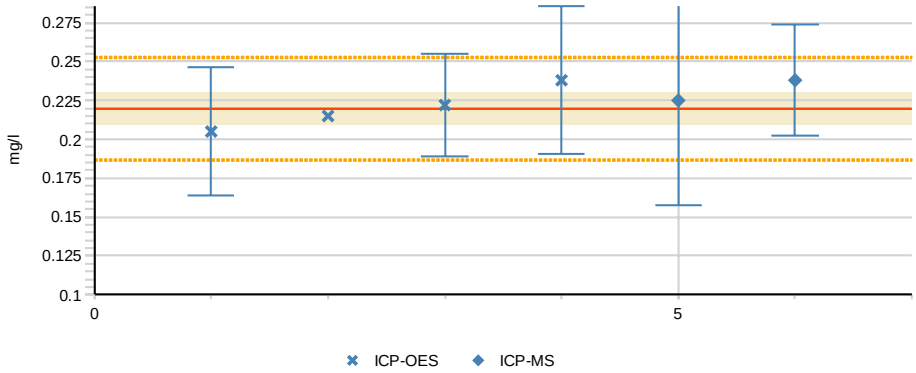
Measurand Sr Sample LO4



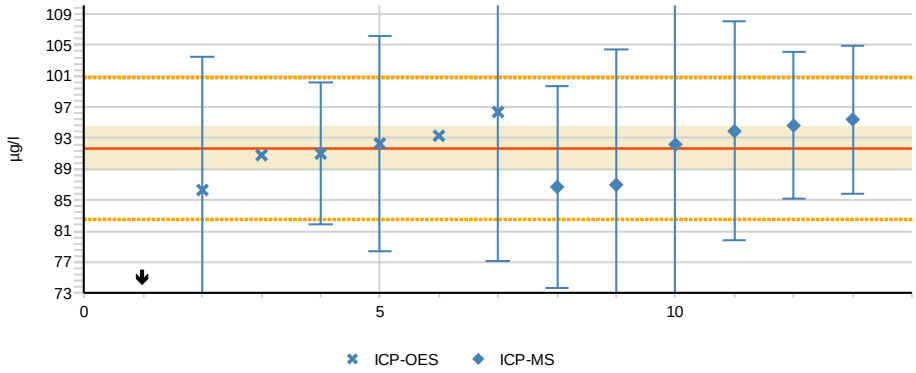
Measurand Sr Sample TN3



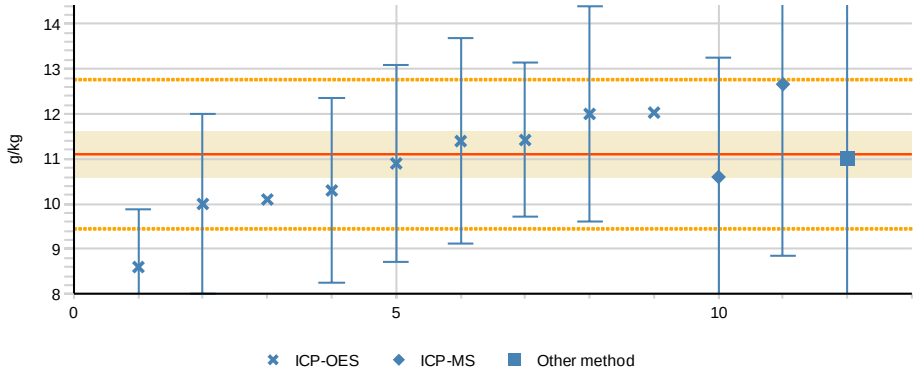
Measurand Sr Sample TY3



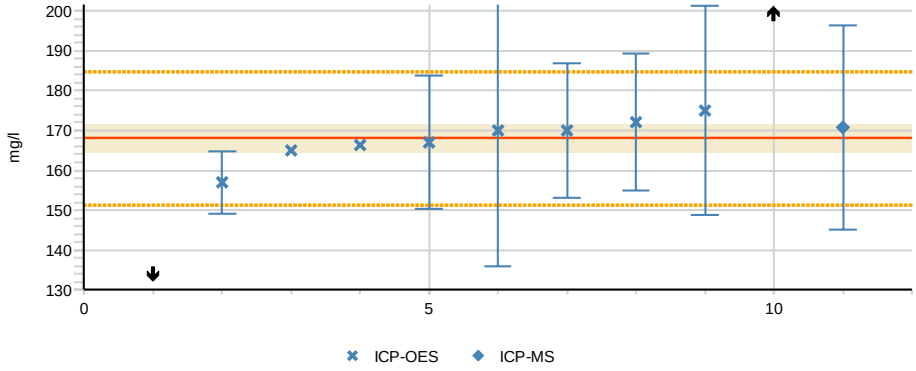
Measurand Sr Sample V2M

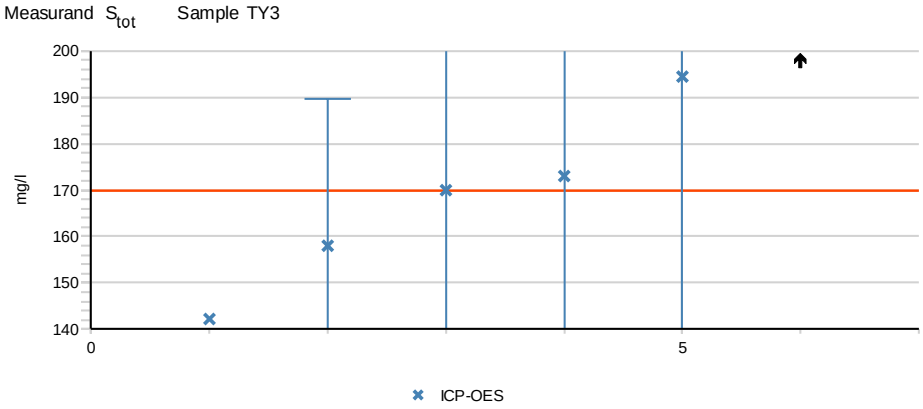


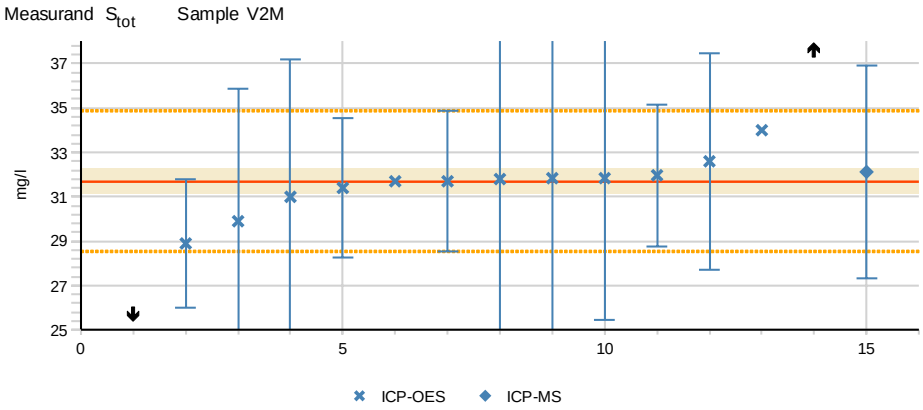
Measurand S_{tot} Sample L4M

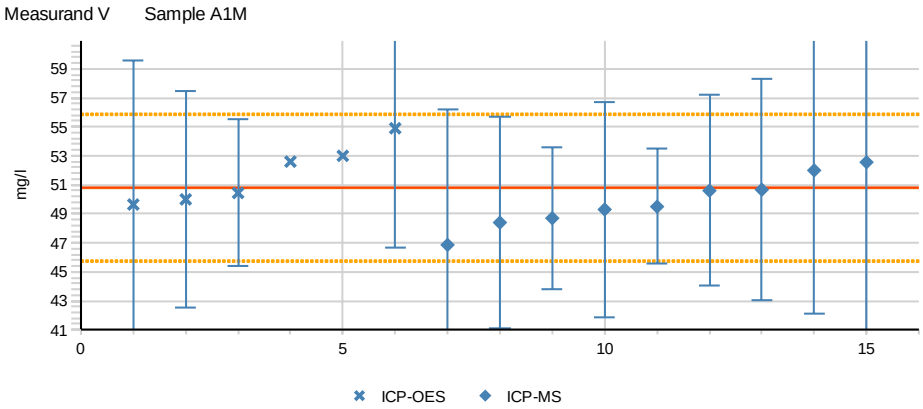


Measurand S_{tot} Sample TN3

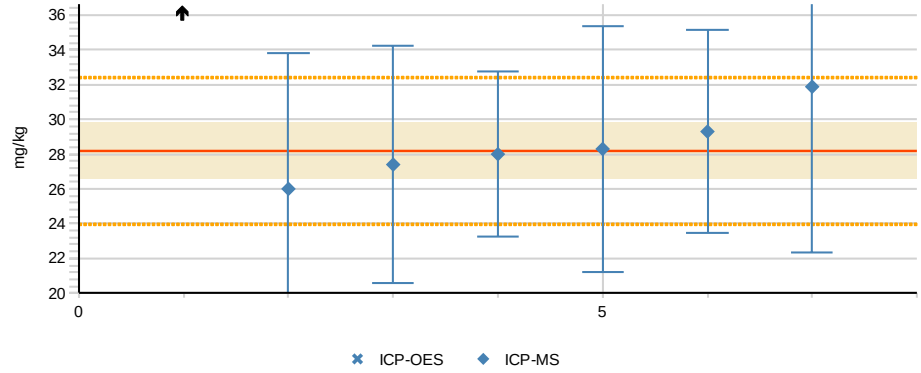



Measurand S_{tot} Sample TY3
mg/l
200
190
180
170
160
150
140
0
5
ICP-OES

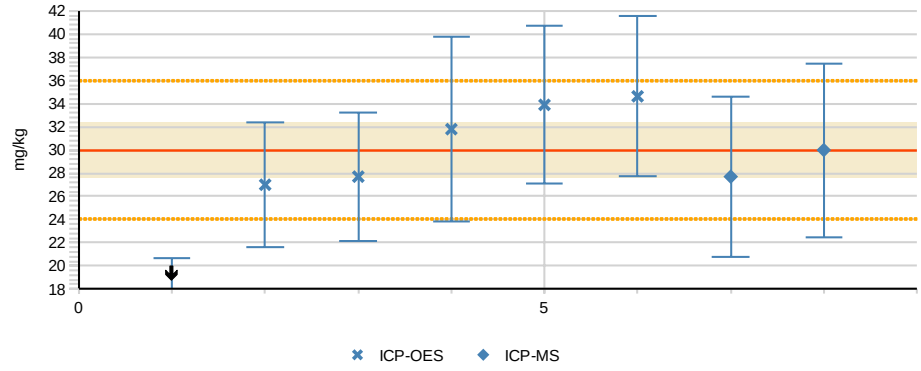

Measurand S_{tot} Sample V2M
mg/l
37
35
33
31
29
27
25
0
5
10
15
ICP-OES
ICP-MS


Measurand V Sample A1M
mg/l
59
57
55
53
51
49
47
45
43
41
0
5
10
15
ICP-OES
ICP-MS

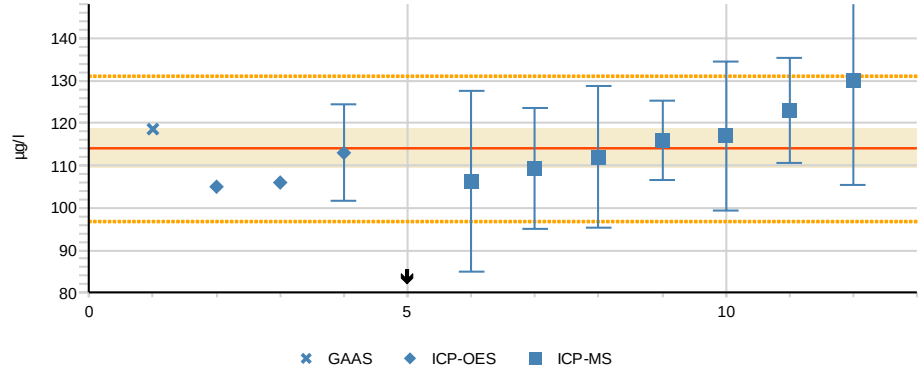
Measurand V Sample LN4



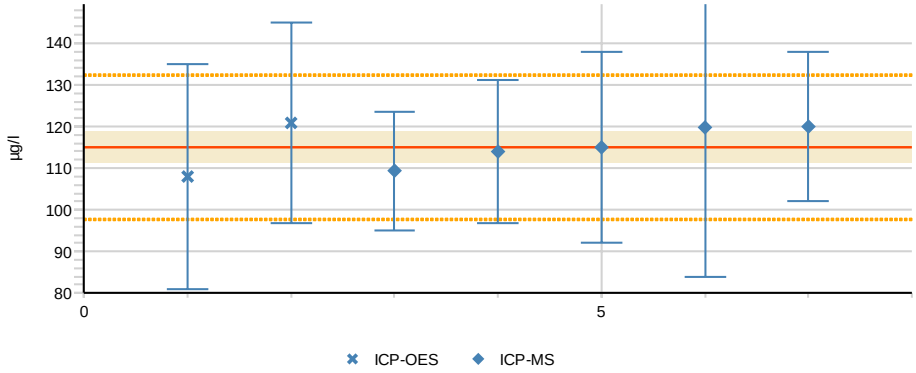
Measurand V Sample LO4



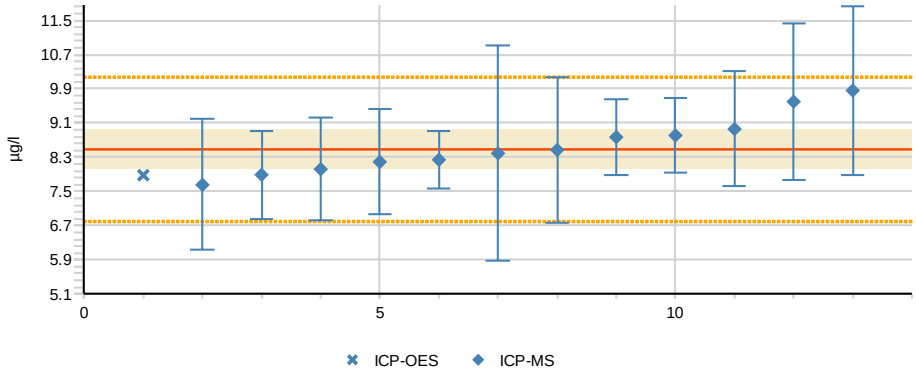
Measurand V Sample TN3



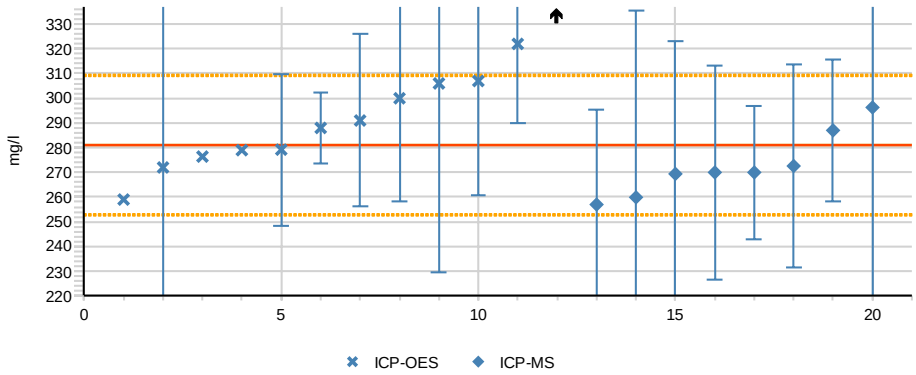
Measurand V Sample TY3



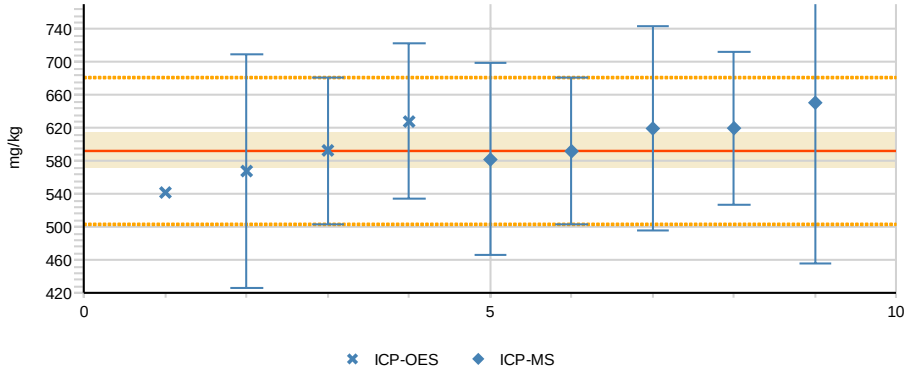
Measurand V Sample V2M



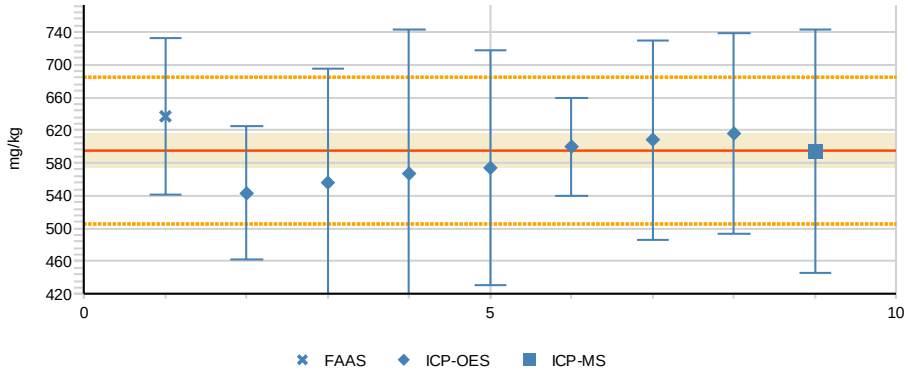
Measurand Zn Sample A1M



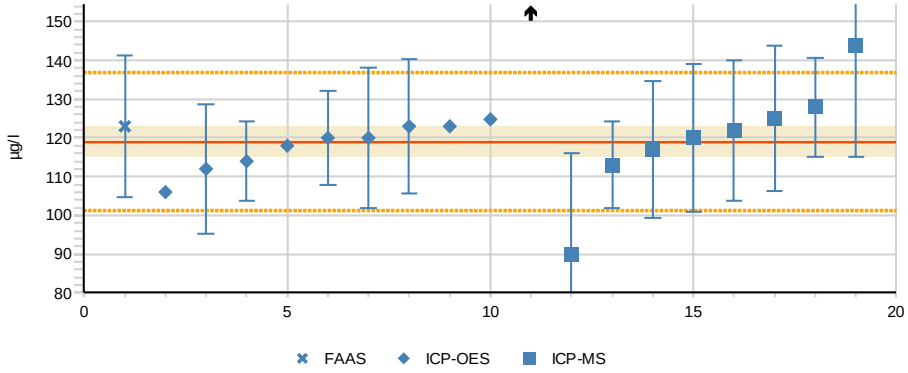
Measurand Zn Sample LN4

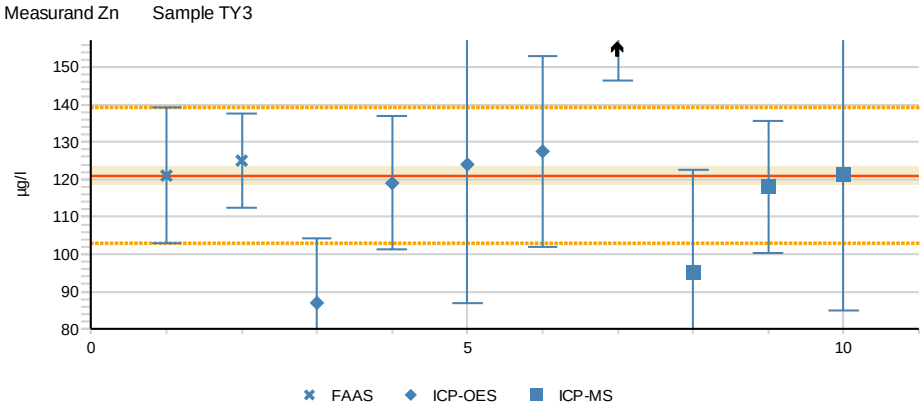


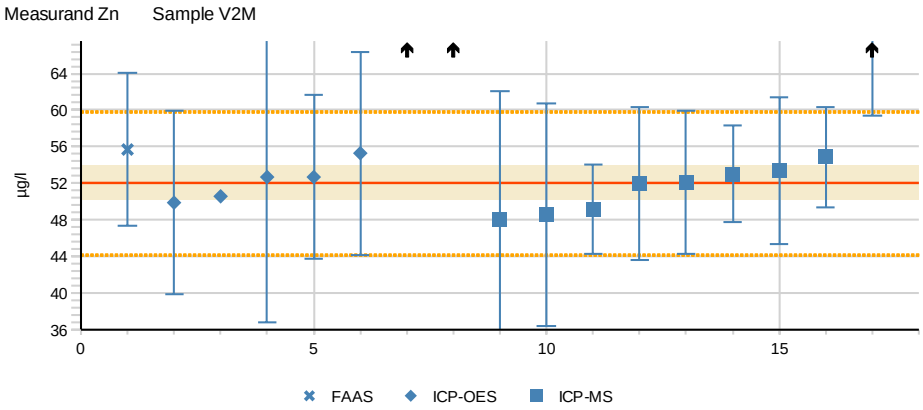
Measurand Zn Sample LO4



Measurand Zn Sample TN3




Measurand Zn
Sample TY3
µg/l
150
140
130
120
110
100
90
80
0
5
10
FAAS
ICP-OES
ICP-MS

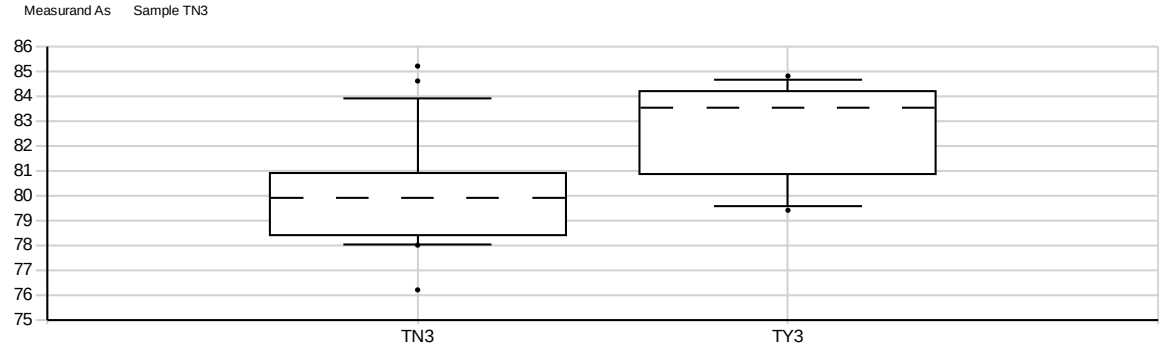

Measurand Zn
Sample V2M
µg/l
64
60
56
52
48
44
40
36
0
5
10
15
FAAS
ICP-OES
ICP-MS

APPENDIX 12: Significant differences in the results reported using different methods

Boxplot figures: In the box the upper and lower limit included 50 % of the results. The dashed vertical line in the middle of the box is the median of the results. The vertical lines above and under the box describe the limits of 80 % of the results. The black dots describe the highest and smallest results within the center 90 % of the results.

Statistically significant differences between pretreatment methods, waste water

TN3 vs. TY3: As

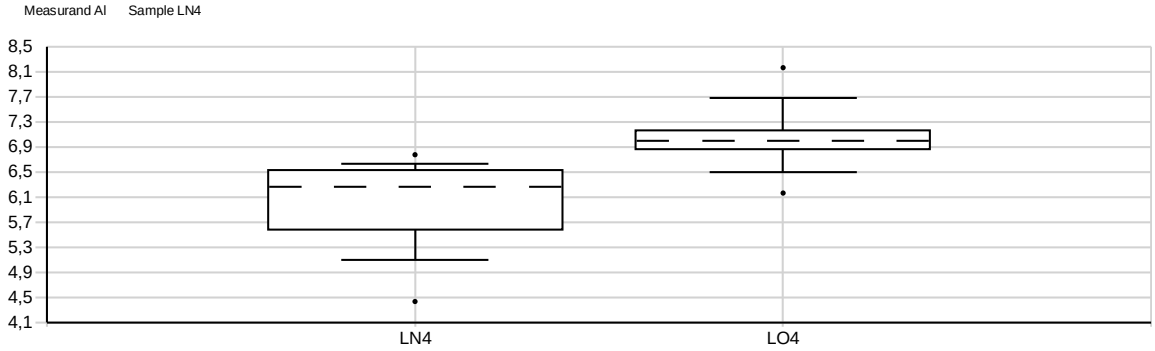


Method	n	Mean (mg/l)	SD (mg/l)
TN3: no digestion	13	80.0	2.6
TY3: digestion with acid or with acid mixture	7	82.5	2.2

n = number of results; SD = standard deviation

Statistically significant differences between pretreatment methods, sludge sample

LN4 vs LO4: Al

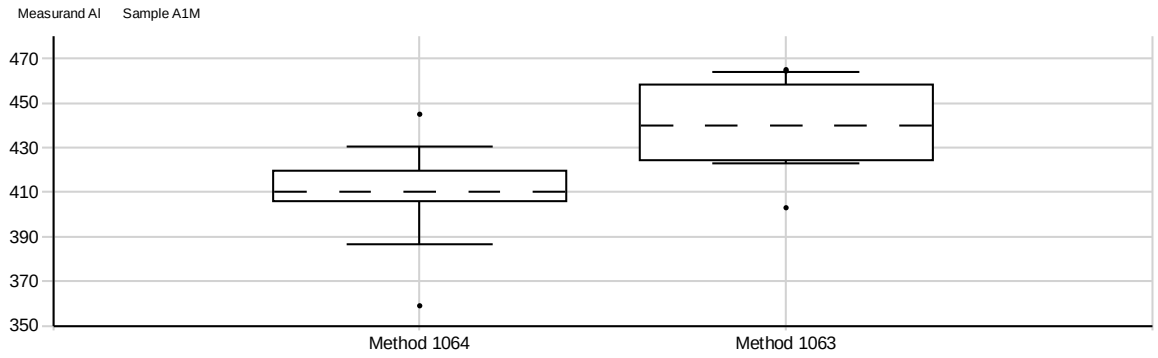


Method	n	Mean (g/kg)	SD (g/kg)
LN4: HNO_3 digestion	6	7.06	0.6
LO4: aqua regia digestion	7	5.95	0.8

n = number of results; SD = standard deviation

Statistically significant differences between analytical methods

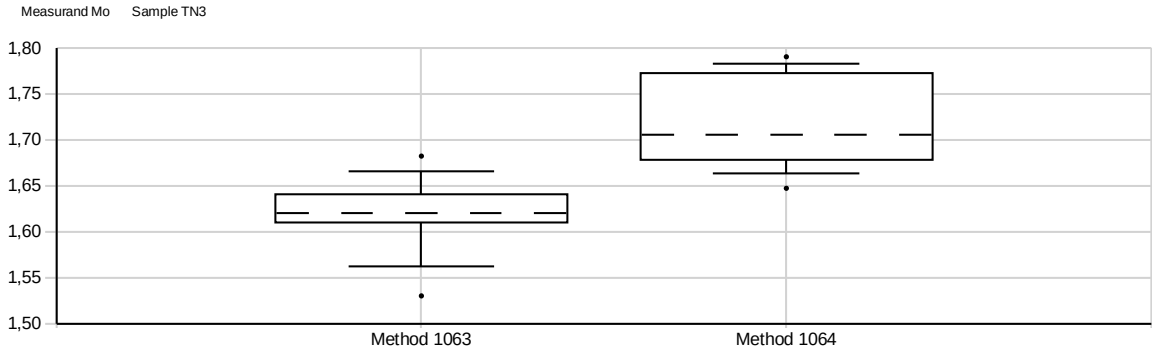
A1M: Al



Method	n	Mean (mg/l)	SD (mg/l)
1064: ICP-MS	7	409	26
1063: ICP-OES	12	441	20

n = number of results; SD = standard deviation

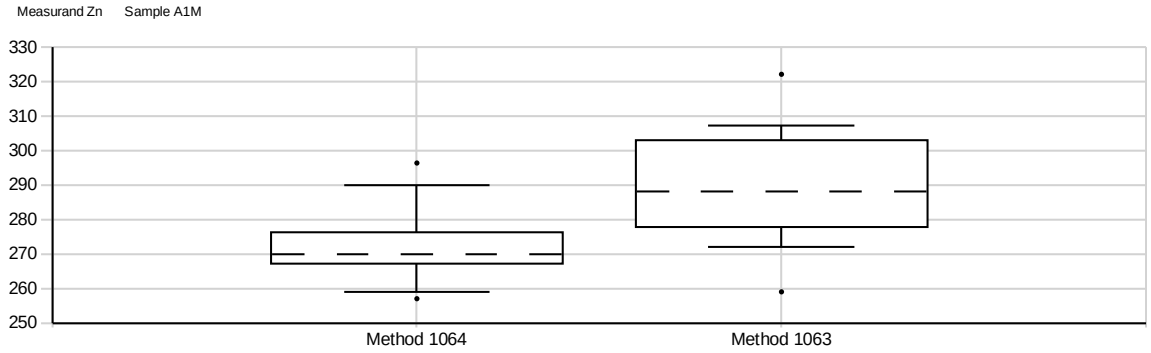
TN3: Mo



Method	n	Mean (µg/l)	SD (µg/l)
1063: ICP-OES	5	1.61	0.06
1064: ICP-MS	8	1.72	0.05

n = number of results; SD = standard deviation

A1M: Zn

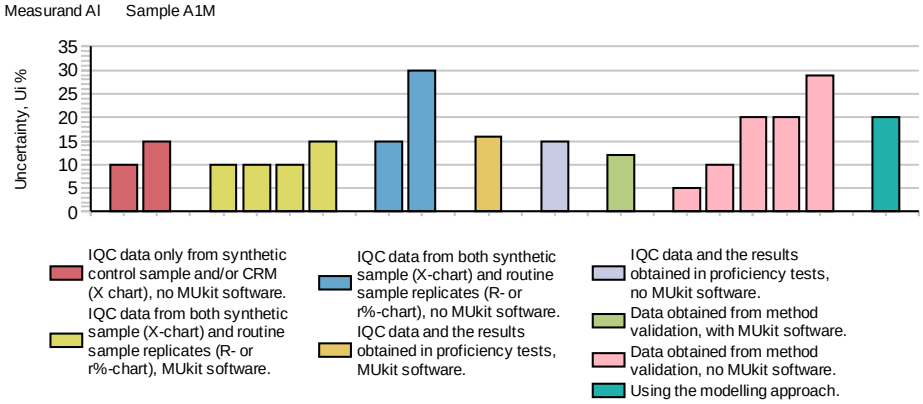


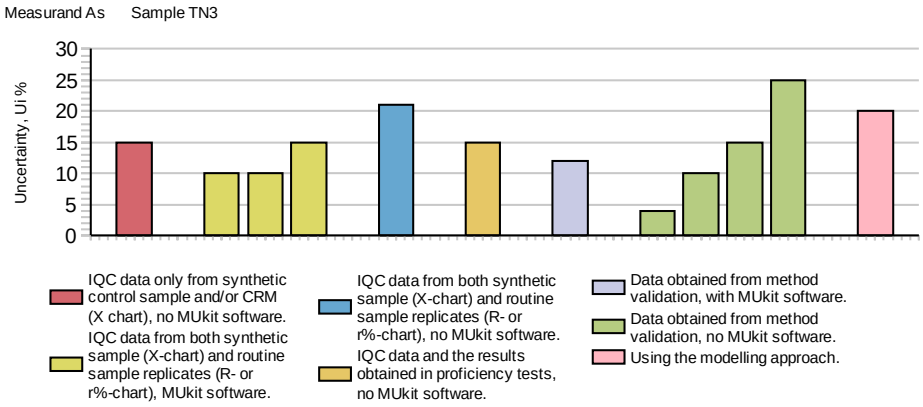
Method	n	Mean (mg/l)	SD (mg/l)
1064: ICP-MS	8	273	13
1063: ICP-OES	11	289	18

n = number of results; SD = standard deviation

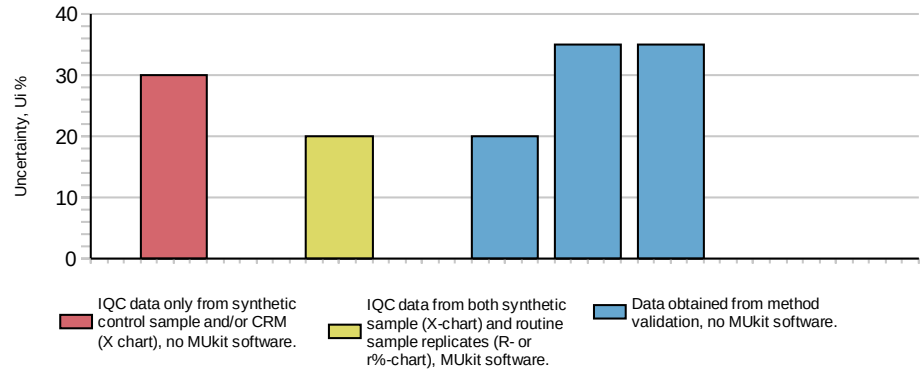
APPENDIX 13: Estimation of the measurement uncertainties reported by the participants

In figures, the presented expanded measurement uncertainties are grouped according to the method of estimation at 95 % confidence level (k=2). The expanded uncertainties were estimated mainly by using the internal quality control (IQC) data. The used procedures in figures below are distinguished e.g. between using or not using the MUkit software for uncertainty estimation [8, 9] or using a modelling approach based [10, 11].

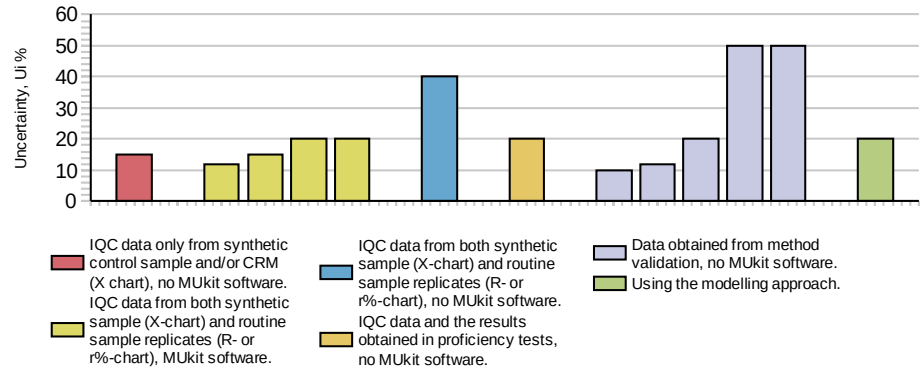




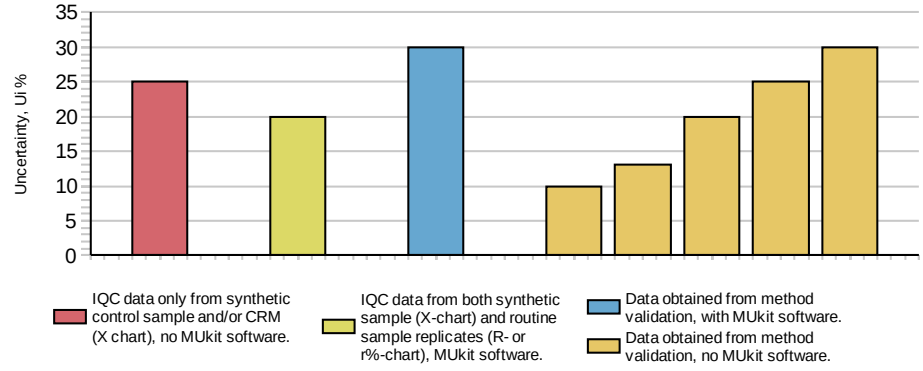
Measurand B Sample LO4

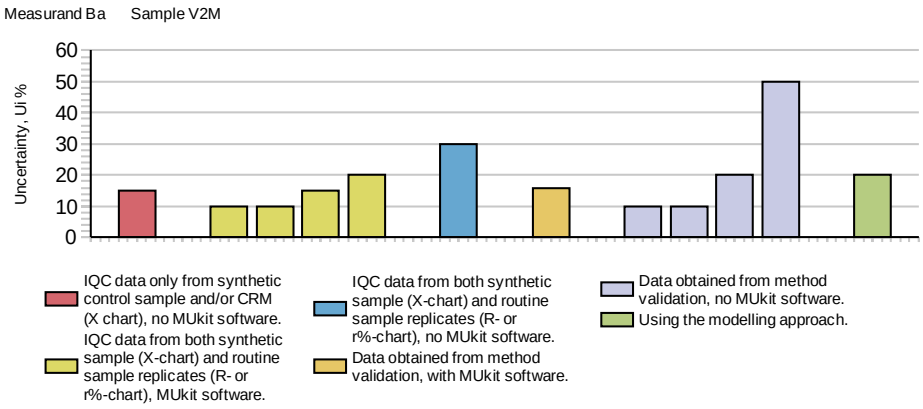


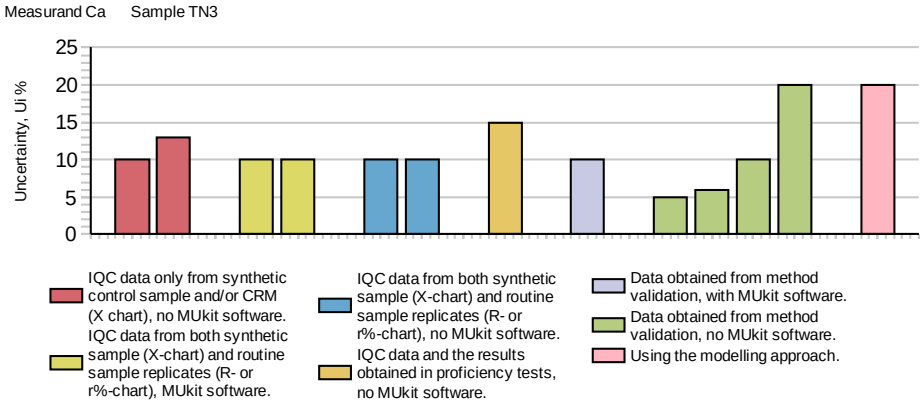
Measurand B Sample V2M

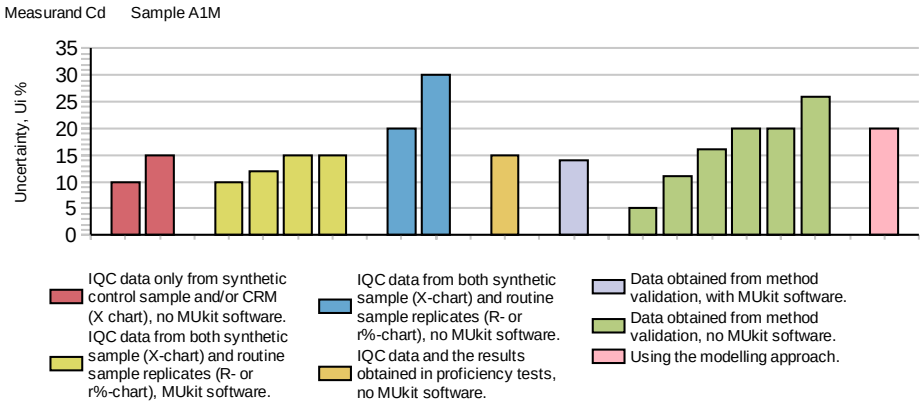


Measurand Ba Sample LO4

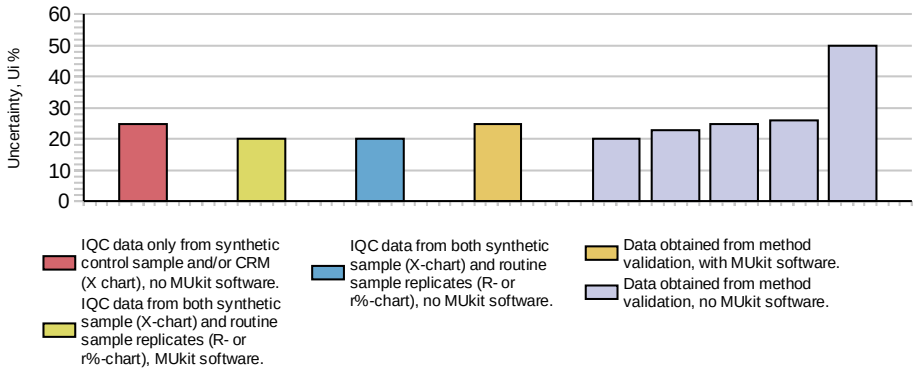



Measurand Ba
Sample V2M
Uncertainty, Ui %
60
50
40
30
20
10
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.

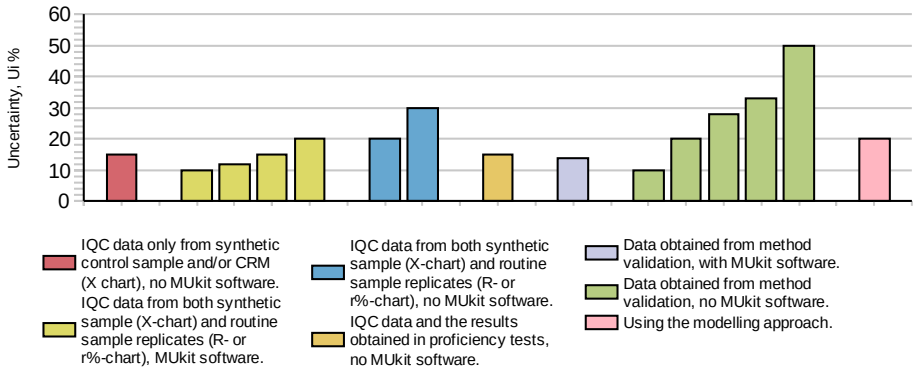

Measurand Ca
Sample TN3
Uncertainty, Ui %
25
20
15
10
5
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.


Measurand Cd
Sample A1M
Uncertainty, Ui %
35
30
25
20
15
10
5
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.

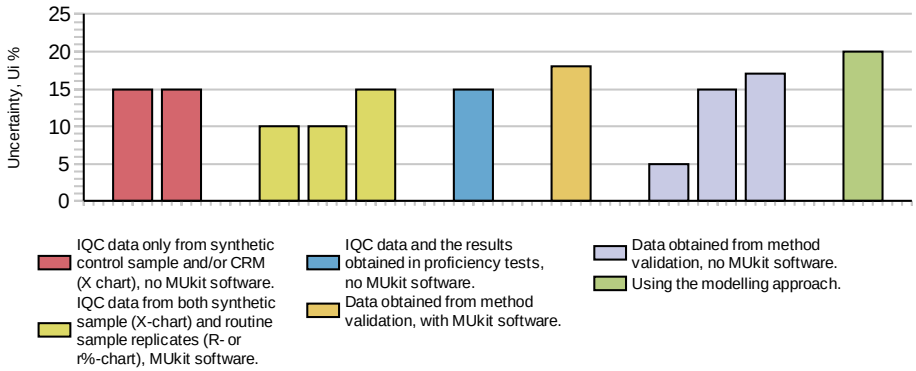
Measurand Cd Sample LO4



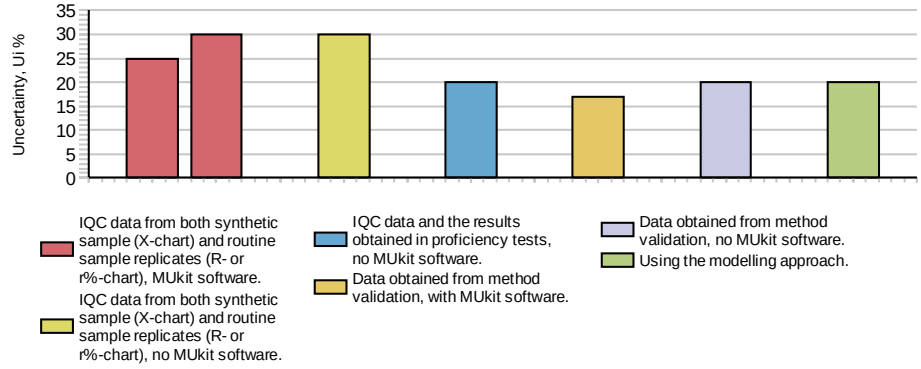
Measurand Cd Sample V2M



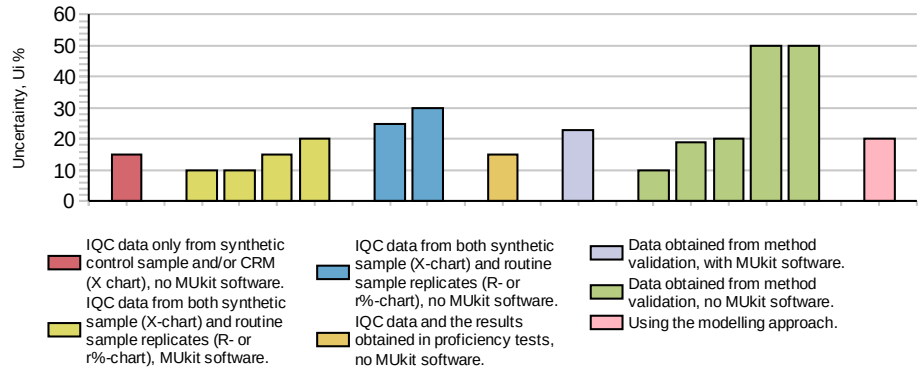
Measurand Co Sample TN3



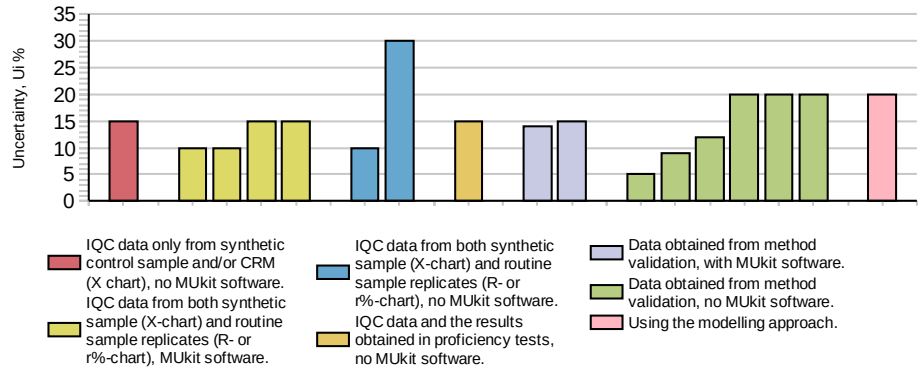
Measurand Cr Sample LN4



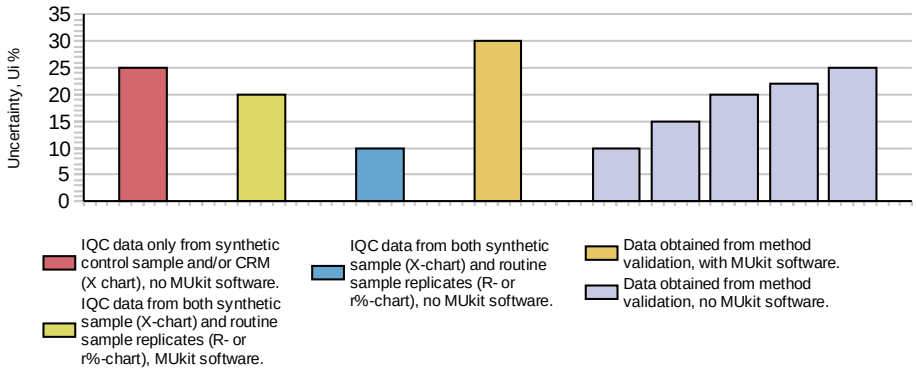
Measurand Cr Sample V2M



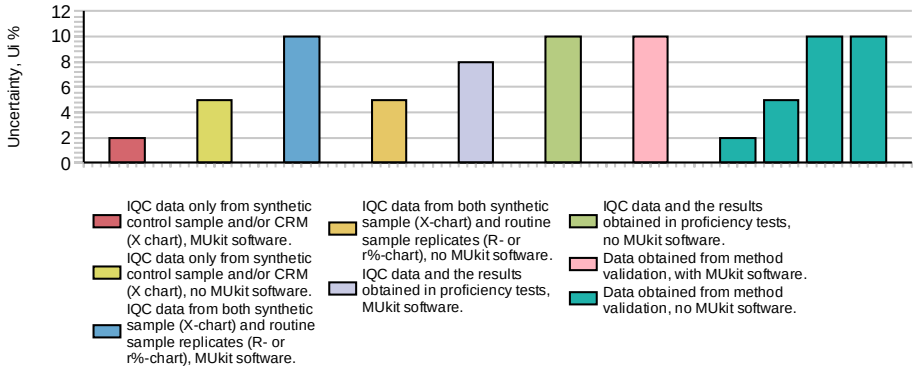
Measurand Cu Sample A1M



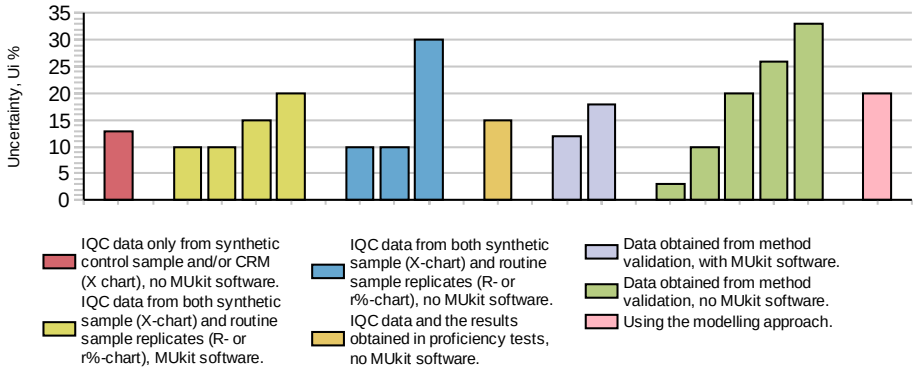
Measurand Cu Sample LO4

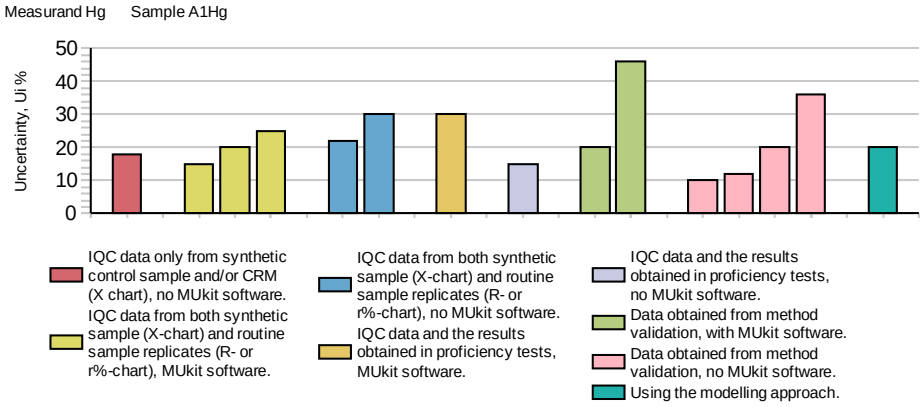


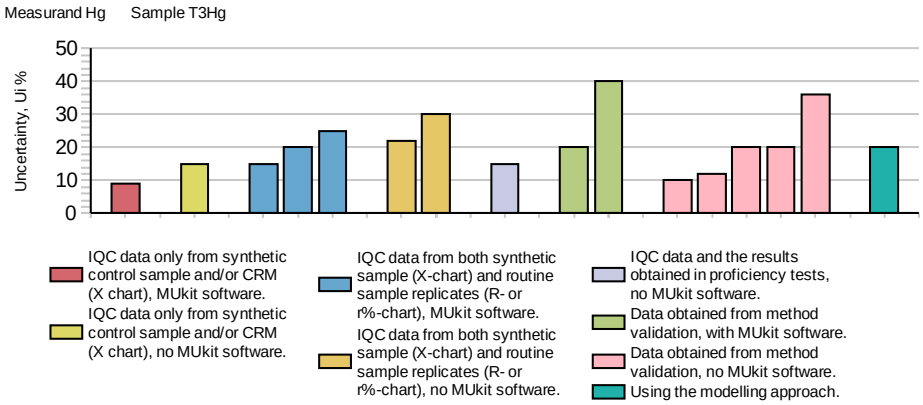
Measurand Drw Sample L4M

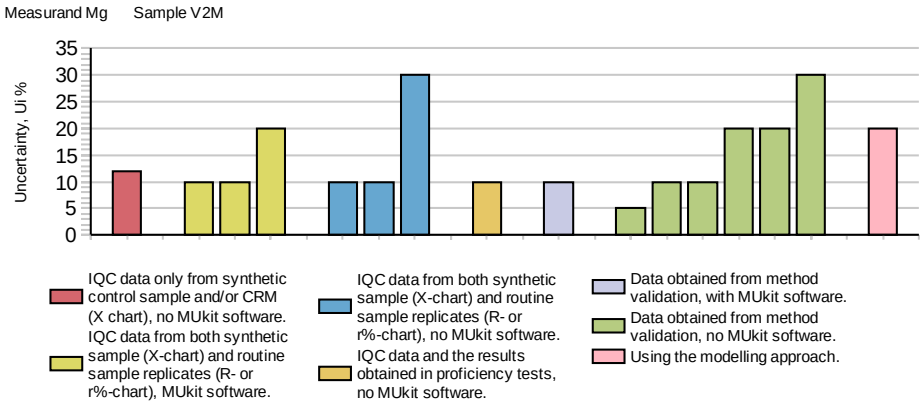


Measurand Fe Sample V2M

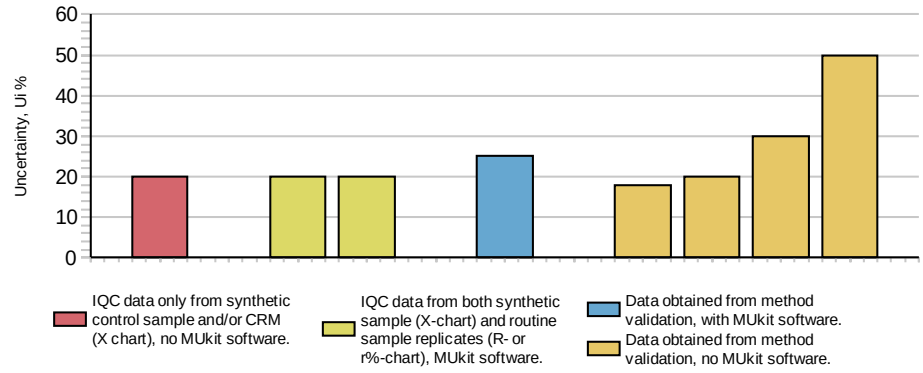



Measurand Hg Sample A1Hg
Uncertainty, Ui %
50
40
30
20
10
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.

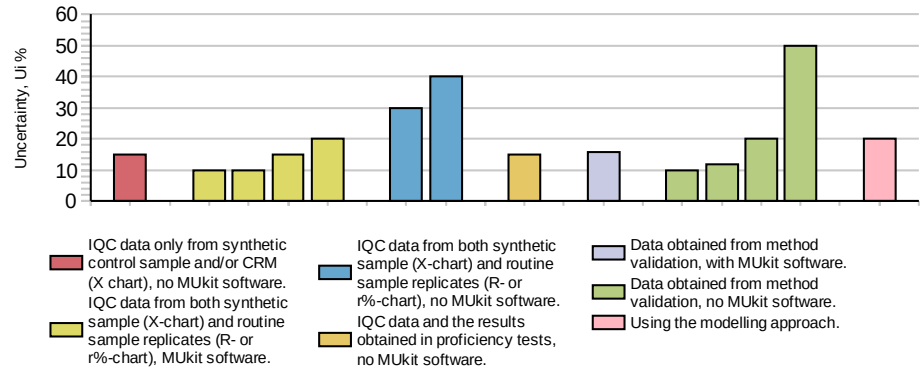

Measurand Hg Sample T3Hg
Uncertainty, Ui %
50
40
30
20
10
0
IQC data only from synthetic control sample and/or CRM (X chart), MUkit software.
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.


Measurand Mg Sample V2M
Uncertainty, Ui %
35
30
25
20
15
10
5
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.

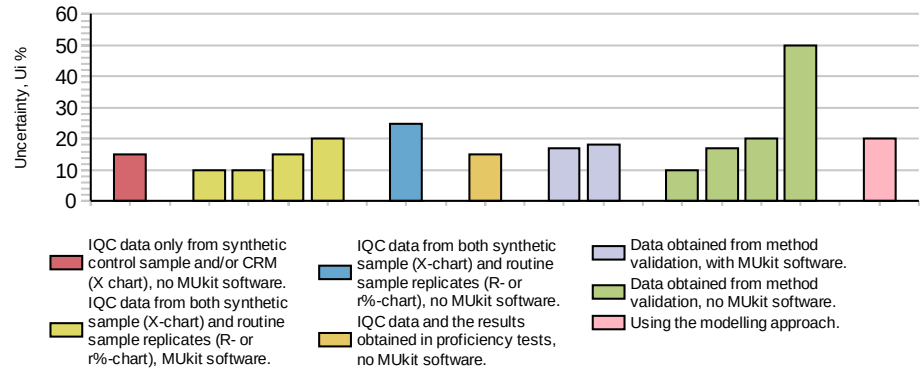
Measurand Mo Sample LO4

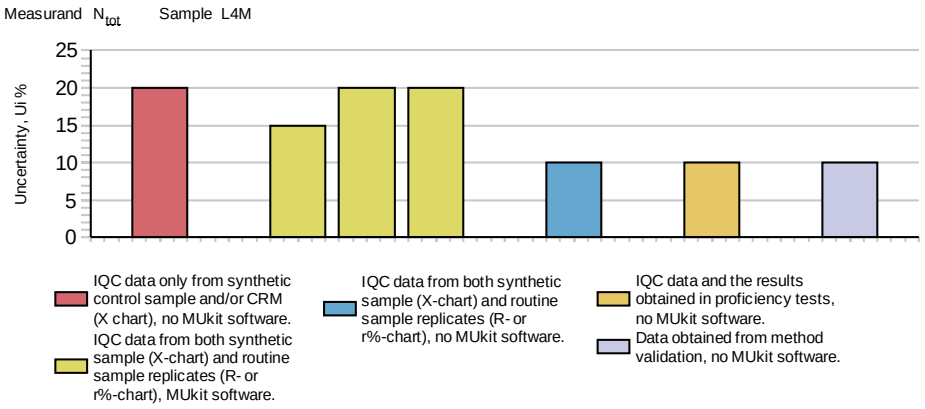


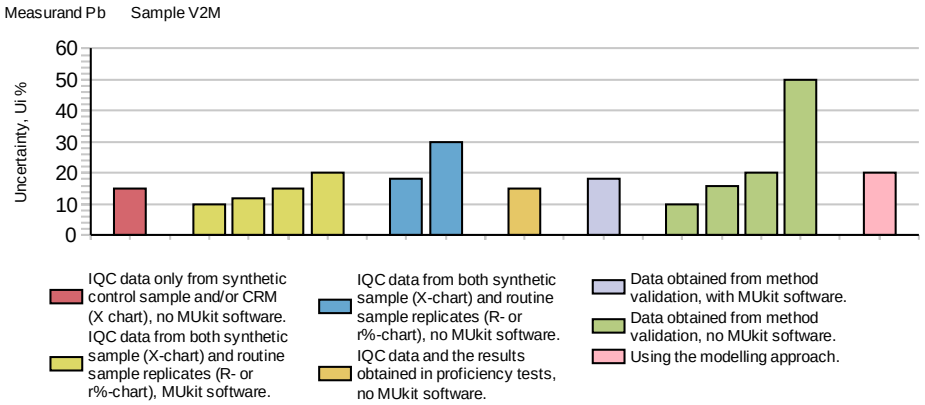
Measurand Mo Sample V2M

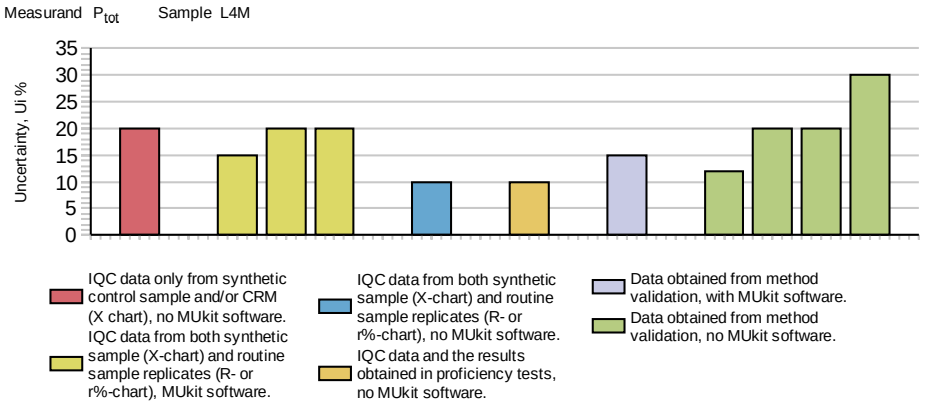


Measurand Ni Sample V2M

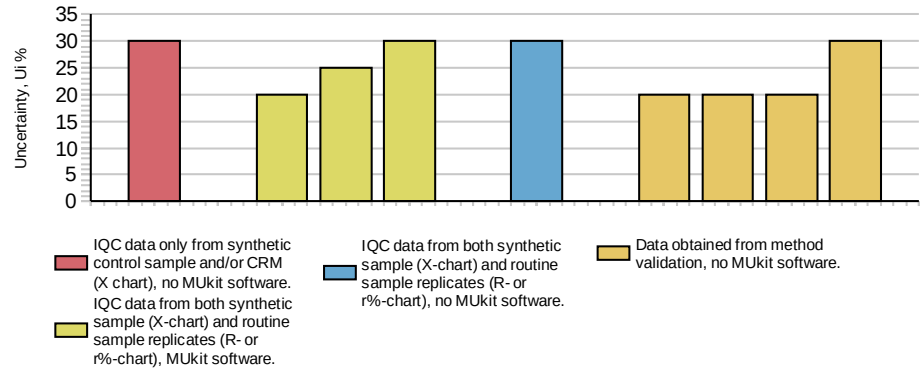



Measurand N_{tot} Sample L4M
Uncertainty, Ui %
25
20
15
10
5
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, no MUkit software.

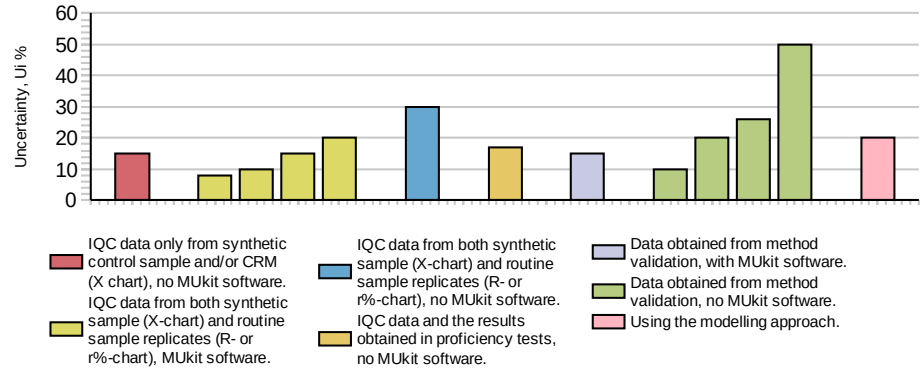

Measurand Pb Sample V2M
Uncertainty, Ui %
60
50
40
30
20
10
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.


Measurand P_{tot} Sample L4M
Uncertainty, Ui %
35
30
25
20
15
10
5
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.

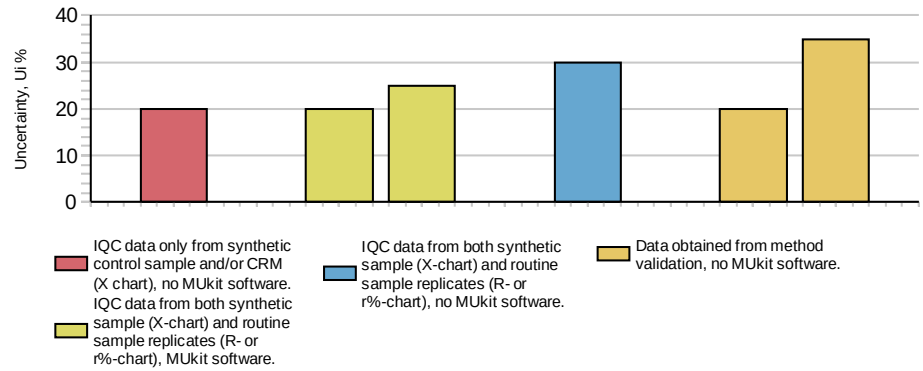
Measurand Sb Sample LO4

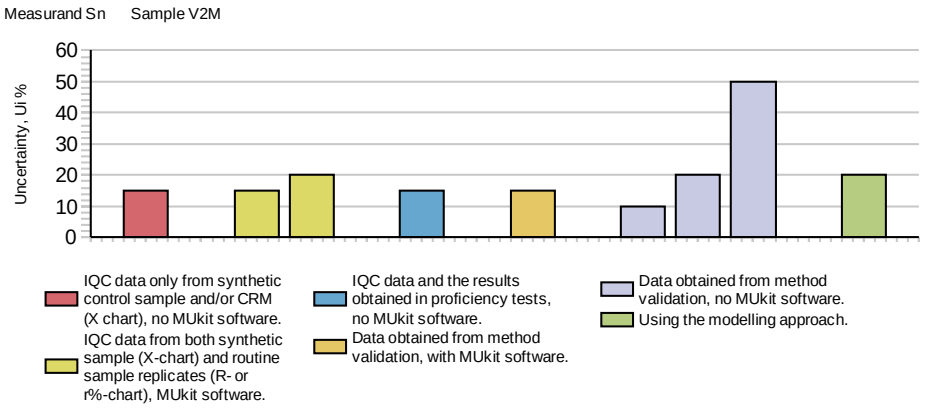


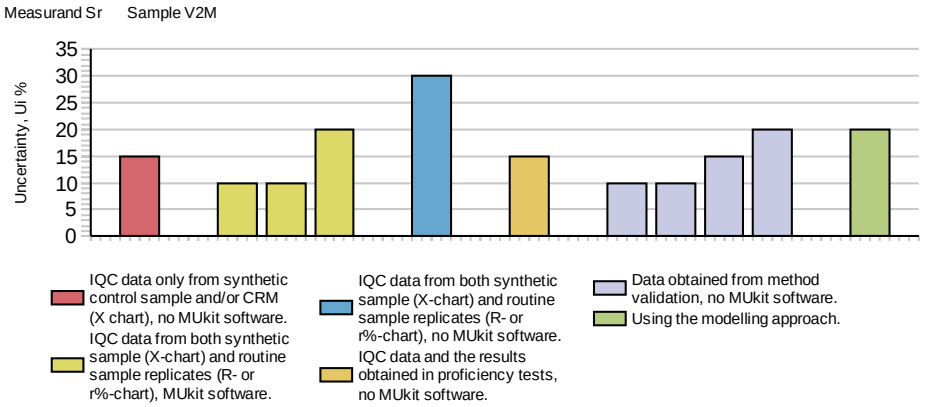
Measurand Sb Sample V2M

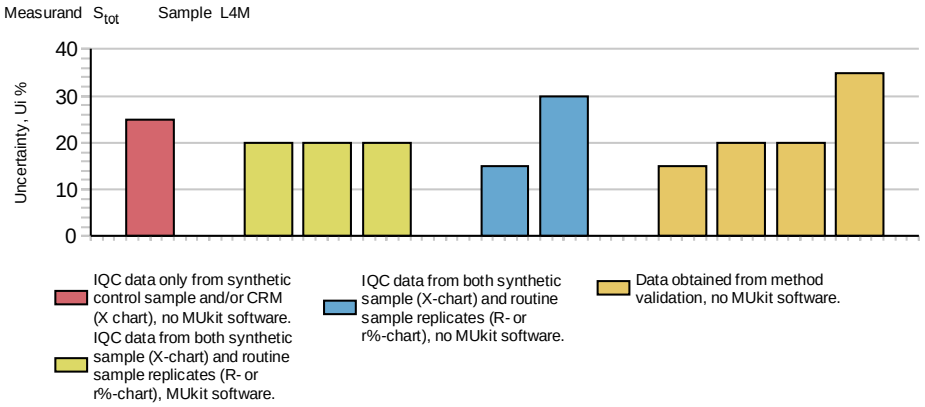


Measurand Sn Sample LO4

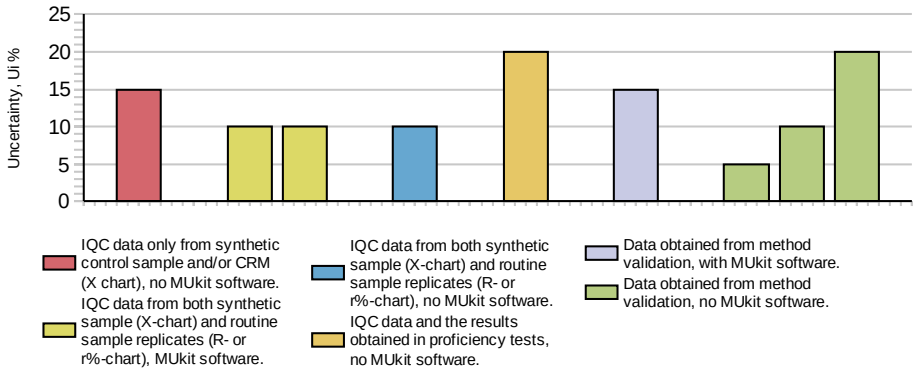



Measurand Sn Sample V2M
Uncertainty, Ui %
60
50
40
30
20
10
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
Data obtained from method validation, with MUkit software.


Measurand Sr Sample V2M
Uncertainty, Ui %
35
30
25
20
15
10
5
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.

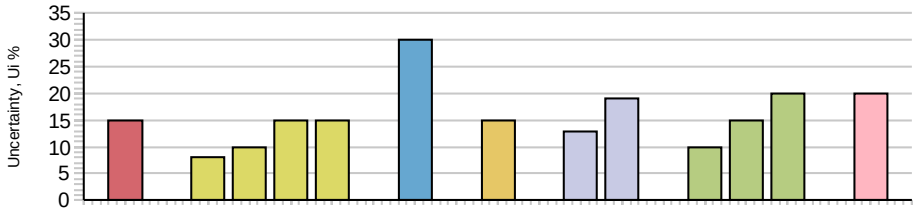

Measurand S_{tot} Sample L4M
Uncertainty, Ui %
40
30
20
10
0
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
Data obtained from method validation, no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.

Measurand S_{tot} Sample TN3



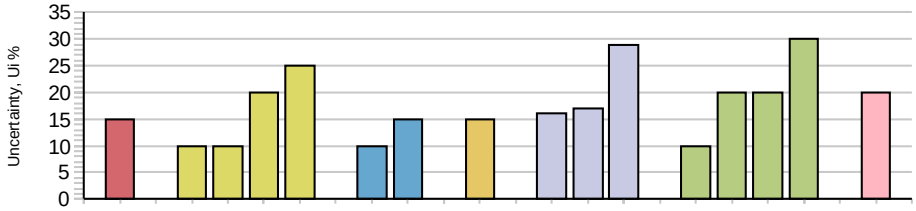
IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.

Measurand V Sample A1M



IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.

Measurand Zn Sample V2M



IQC data only from synthetic control sample and/or CRM (X chart), no MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), MUkit software.
IQC data from both synthetic sample (X-chart) and routine sample replicates (R- or r%-chart), no MUkit software.
IQC data and the results obtained in proficiency tests, no MUkit software.
Data obtained from method validation, with MUkit software.
Data obtained from method validation, no MUkit software.
Using the modelling approach.

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